American Potato Journal

Volume XIV April, 1937 Number 4

GRADE ANALYSIS OF POTATOES ON THE CLEVELAND MARKET[1]

E. V. HARDENBURG

Cornell University, Ithaca, N. Y.

A number of consumer preference studies have been made recently in our leading potato markets. The apparent decline in potato consumption and the need for basic information on the likes and dislikes of the city buyer have prompted these studies. This is a new type of potato investigation which is bound to increase. The value of results will depend largely on the technique employed and the accuracy of our interpretations. To date, studies of this nature have been made by Experiment Station workers in Maine, Minnesota, New Hampshire, New York, Pennsylvania and Wisconsin. In most cases the housewife has been included as the principal source of information. Wholesale and retail buying procedure in our large cities are no less important as a source of basic information.

In March 1936, the Departments of Agricultural Economics, Home Economics and Vegetable Crops of the New York State College of Agriculture began an intensive study of potato marketing in Cleveland, Ohio. Buying and handling practices of receivers, wholesalers, jobbers, and retailers as well as home utilization are being studied. Cleveland was selected for this study, because of its size and the fact that it consumes potatoes from a wide range of producing area. Last March Cleveland was receiving eight distinct kinds of potatoes from at least seven states, therefore affording the trade ample opportunity for consumer preference. Only one phase of this study will be discussed in this paper,—that involving market quality as determined by grade analysis.

Much information is available regarding the incidence of tuber defects in potatoes at the farm and at the shipping point. Here we have recourse to the records from field studies and shipping point inspection reports. We have very little knowledge of the defects found in these same potatos when offered at retail. In this discussion the yardstick

[1]Published as Paper No. 154, Department of Vegetable Crops, Cornell University.

of market quality in reference to specific tubers defects is damage or serious damage as defined in U. S. grade standards. Some of the studies previously reported use the terms, major and minor defects, in which cases major defects refer to damage that is serious enough to throw the sample out of No. 1 grade.

During the months of March and April records on buying procedure were taken in sixty-four Cleveland stores. Several varieties were offered at different prices in various packs in each of these stores. A fifteen-pound sample of each lot of potatoes offered by each of these stores was purchased and shipped to Ithaca in barrels. Care was taken to avoid any possibility of bruising in transit or subsequent handling. In this way a total of one hundred and forty-three samples was analyzed as the basis for this study. In the interpretation of these results it must be kept in mind that the purpose was not to compare potatoes from different states, much less to reflect any criticism. Furthermore, the data on mechanical injury represent the cumulative results of several handling procedures from digging to retailing and not solely the carelessness of the grower. By reference to table 1, it will be noted that only approximately 11 per cent of these samples graded U. S. No. 1 or better, whereas over 40 per cent graded culls. Even though this may seem a surprisingly poor record to which all states of origin are contributory, we believe that the analyses were carefully made and the results are representative of potatoes bought by the consumer at that time. The specific defects responsible for the analysis shown in table 1 will be discussed in this paper.

Grade and State of Origin Related to Retail Price

In relating market grade to retail price, it should be remembered that potatoes sold at retail stores are seldom labelled as to grade. Furthermore, potato growers commonly feel that grading does not pay and that they receive no premium for graded stock. The average price a pound paid for each grade as determined on 140 retail samples is indicated in table 2.

Even though these potatoes were not sold on grade it is evident that the better quality samples did cost the buyer more money than the poorer stock. Most of the 64 stores offered potatoes from Idaho, Florida and one other state. The Idaho potatoes, always the Russet Burbank variety, were in demand for baking and were commonly packed fancy. Buyers often asked for them either as bakers or as Idahoes but never as Burbanks. With the exception of the Florida potatoes, they sold for the highest average price as shown in table 3. Florida stock represented new crop potatoes and sold for the highest price.

TABLE 1.—*Grade analysis of* 143 *retail potato samples in Cleveland market—March,* 1936

State of Origin	Percentage of Samples Graded					Total Number of Samples	Per cent of Total
	U. S. Fancy	U. S. No. 1	U. S. Commercial	U. S. No. 2	Culls		
Maine	0.0	4.8	23.8	21.4	50.0	42	29.4
Florida	5.9	11.8	32.4	20.6	29.4	34	23.8
Ohio	0.0	3.2	32.3	6.5	58.1	31	21.7
Idaho	11.5	11.5	38.4	15.4	23.1	26	18.2
Colorado	0.0	0.0	40.0	40.0	20.0	5	3.5
Wisconsin ..	0.0	25.0	0.0	25.0	50.0	4	2.8
New York ..	0.0	0.0	0.0	100.0	0.0	1	0.7
Total and Average	3.5	7.7	30.1	18.2	40.5	143	100.0

TABLE 2.—*Relation of retail price to potato grades.* 140 *sales in* 64 *Cleveland stores—March,* 1936

Grade	Number of Samples	Ave. Quantity Purchased (Pounds)	Ave. Amount Paid	Ave. Price per Pound
U. S. Fancy.....	5	6.1	$0.280	$0.0460
U. S. No. 1.....	11	5.9	0.205	0.0350
U. S. Commercial.	42	8.0	0.243	0.0303
U. S. No. 2.....	25	6.9	0.205	0.0296
Culls	57	8.3	0.227	0.0275
Total and Average	140	7.7	$0.228	$0.0297

These potatoes were of the Bliss Triumph variety. The retail price of Maine Green Mountains averaged about three cents a pound higher than Ohio potatoes which were mostly Russet Rurals.

INSECT AND RODENT INJURY

In analyzing the one hundred and thirty-three samples from Maine, Florida, Ohio and Idaho for damage caused by insects and rodents it was found that wireworms were most prevalent followed in order by scab-gnats, millipeds, mice, grubs and slugs. The average per cent of all samples damaged or seriously damaged by these pests is shown in table 4. None of the Idaho samples showed damage by tuber insects. Although the incidence of wireworms, milliped and scab-gnat damage was high in the Ohio potatoes it should be noted that the data presented do not represent the actual percentage of damage done.

TABLE 3.—*Relation of retail price to state of origin. 140 sales in 64 Cleveland stores—March, 1936*

State	Number of Samples	Ave. Quantity Purchased (Pounds)	Ave. Amount Paid	Ave. Price per Pound
Maine	42	9.85	$0.258	$0.0262
Florida	33	3.71	0.192	0.0517
Ohio	32	9.17	0.216	0.0235
Idaho	25	6.62	0.242	0.0366
Colorado	3	8.33	0.210	0.0252
Wisconsin	4	12.50	0.268	0.0214
New York	1	5.00	0.130	0.0260
Total and Average	140	7.70	$0.228	$0.0297

TABLE 4.—*Prevalence of insect or rodent injury in potato samples in Cleveland market—March-April, 1936*

State of Origin	Total Samples Analyzed	Percentage of Samples Damaged and/or Seriously Damaged by					
		Wire-worms	Grubs	Milli-peds	Scab Gnats	Slugs	Mice
Maine	42	4.8	4.8	2.4	11.9	0.0	2.4
Florida	34	2.9	0.0	8.8	11.8	2.9	0.0
Ohio	31	67.7	16.1	32.3	32.3	0.0	19.4
Idaho	26	0.0	0.0	0.0	0.0	0.0	0.0

PHYSIOLOGICAL DEFECTS

In this study such defects as growth cracks, misshape, sunburn, second growth and air cracks have been classified as physiological. Except for air cracks all of these are, of course, contingent on environmental conditions during growth rather than on marketing procedure. The percentage of samples containing tubers damaged or seriously damaged by these defects is shown in table 5.

In order of prevalence, misshape was most common, followed in order by growth cracks, sunburn, second growth and air cracks. Here again, the relatively high prevalence of these defects in the Ohio samples may indicate that the Rural type of potato is especially subject to these troubles. Although it is well known that the Burbank variety grown in Idaho is very subject to second growth no damage from either second growth or sunburn was found in the Idaho samples. Of the physiological defects misshape was the most common in Maine potatoes, sunburn injury in Florida, misshape in Ohio and growth cracks in Idaho.

Varietal Mixture

By definition under U. S. standards, all potato grades including the No. 2 shall be of one variety or of similar varietal characteristics. So long as our federal and state inspection service allows different varieties of the so-called "round white" type to pass in the same container this requirement is often not strictly observed No one will dis-

Table 5.—*Prevalence of physiological defects in potato samples in Cleveland market—March-April,* 1936

State of Origin	Total Samples Analyzed	Percentage of Samples Damaged and/or Seriously Damaged by				
		Growth Cracks	Mis-shape	Sun-burn	Second Growth	Air Cracks
Maine	42	9.5	35.7	11.9	4.8	9.5
Florida	34	8.8	2.9	11.8	0.0	0.0
Ohio	31	35.5	51.6	45.1	16.1	12.9
Idaho	26	19.2	7.7	0.0	0.0	3.8

pute the facts that Cobblers, White Rurals and Green Mountains, although "round-whites," when mixed in the container, do not provide for a uniformly cooked product. The incidence of varietal mixture found in the one hundred and forty-three retail samples from seven states is indicated in table 6.

Standardization of varieties is apparently not a problem in Florida and Idaho. No mixture was found in the samples from these states. However, the situation could apparently be improved in other states. Too few samples were available from Colorado, Wisconsin and New York to get a reliable indication of the status of this factor in these states.

Tuber Bruising

Since 1930 several investigations of damage by bruising both at harvest and during subsequent handling have been reported. Waugh and his co-workers (1930) reported on a study of market preferences for Maine potatoes found in the Boston and New York markets. The relation of specific tuber defects to price was based on approximately 1000 cars inspected in these markets.The percentage of bruising damage varied from one to sixty per cent and they concluded that "forty per cent of the differences in price from one car to another were due to differences in the amount of bruises". In the same year Spangler (1930) reported a study of the relation of quality to market price in six

TABLE 6.—*Varietal mixture in potatoes sold in Cleveland—March-April, 1936*

State	Total Number Samples	Per Cent of Samples Containing Varietal Mixture of Following Percentage				
		None	1 to 9	10 to 19	20 to 29	Over 30
Maine	42	80.9	11.9	4.8	2.4	0.0
Florida	34	100.0	0.0	0.0	0.0	0.0
Ohio	31	54.8	19.4	6.4	0.0	19.4
Idaho	26	100.0	0.0	0.0	0.0	0.0
Colorado	5	60.0	40.0	0.0	0.0	0.0
Wisconsin	4	50.0	25.0	25.0	0.0	0.0
New York	1	100.0	0.0	0.0	0.0	0.0
Total and Average	143	81.8	9.8	3.5	0.7	4.2

eastern cities. He interviewed four hundred and sixteen persons including carlot receivers, jobbers, brokers, chain store buyers and independent retailers as a result of which it was concluded that "the most common defect found among Maine potatoes was mechanical injury". According to Werner (1931), mechanically injured tubers found in the bins of Triumph certified seed potato growers in Nebraska during the years 1928, 1929 and 1930, average 31, 16 and 17 per cent respectively. A little later Hastings (1932) reported that an average of 38 per cent of all the tubers examined behind fifty diggers in North Dakota showed mild to serious digger bruising. Hardenburg (1933) in a survey of 238 New York potato fields found that about 13 per cent of all tubers were mechanically injured during the digging process. This included all bruising without reference to the extent of damage done. A very intensive study of this problem was reported by Schrumpf (1933) in Maine. The data on tuber injury, during 1931 and 1932, were obtained in a large number of fields, farm storages and track-side houses in Aroostook County. He reported an average of 7.1 per cent major and 40.7 per cent minor injuries, or a total of 47.8 per cent mechanical injury of potatoes resulting from harvesting, handling and storage. Finally, Bakken, of Wisconsin, in 1934, in a study made mainly in Milwaukee, Madison and Chicago markets, reported that about 4 per cent of all the Wisconsin potatoes found in these markets were mechanically injured in harvesting, grading and handling. He further stated that of the 20.4 per cent of these potatoes representing waste to the consumer, one-fifth of it was the result of bruising. During the season 1934-1935 the federal-state shipping point inspection service in New York examined about 970 cars of potatoes. One hundred and

eighty-seven of these, or about 20 per cent, failed to grade U. S. No. 1. Of an average of 7.3 per cent damage from all defects, 1.5 per cent was caused by cuts and bruises. The seriousness of this particular type of defect, therefore, is strongly indicated.

The average percentage by weight of damage and/ or serious damage from all causes and from bruising alone in the 143 Cleveland samples is shown in table 7. Whereas 24.1 per cent by weight of all these potatoes were damaged from all defects, 42.7 per cent of this total were due to bruising alone. Bruising appeared to be more serious in Maine potatoes than in those from any other state. That this difference may be caused by the comparatively high susceptibility of the Green Mountain variety to mechanical injury is indicated, but can not be proved by the data obtained. However, it is evident that bruising is the most serious single defect found on the Cleveland market. The incidence of damage from bruising found in the eight varieties offered in the sixty-four retail stores is shown in table 8.

Too few samples of varieties, other than Green Moutain, Russet Rural, Bliss Triumph and Russet Burbank, were available for comparison in regard to this factor. The comparative damage found on the four above-named varieties, however, was in the order listed. That the Bliss Triumph variety did not show even more damage may be because a considerable proportion of these potatoes was packed in bushel crates.

Since the method of handling potatoes after they reach the city market varies with the type of store, it was decided to compare the

TABLE 7.—*Tuber bruising as a factor affecting potato grades.* 143 *retail samples—Cleveland market—March-April,* 1936

State of Origin	Number of Samples	Average Weight of Sample Graded (Grams)	Average Weight of Tubers Damaged and/or Seriously Damaged (Per Cent)	Tubers Damaged or Seriously Damaged by Bruising Per Cent of Total Damaged		
				Damaged	Seriously Damaged	Total
Maine	42	4535	26.3	42.0	19.9	61.9
Florida	34	2121	19.7	25.2	9.9	35.1
Ohio	31	4141	27.9	18.5	3.9	22.4
Idaho	26	3281	17.1	29.6	6.4	36.0
Colorado...	5	4439	21.5	39.2	6.8	46.0
Wisconsin..	4	4444	27.5	41.6	2.0	43.6
New York.	1	4528	25.0	0.0	0.0	0.0
Total and Average ...	143	3642	24.1	31.4	11.3	42.7

TABLE 8.—*Relation of variety to tuber bruising in Cleveland market. 143 retail store samples—March and April, 1936*

Variety	Number of Samples	Damaged		Seriously Damaged	
		Average Per Cent	Per Cent of Samples	Average Per Cent	Per Cent of Samples
Green Mountain	41	10.67	87.8	5.19	65.9
Russet Rural	33	6.59	63.6	1.16	24.2
Bliss Triumph	33	5.05	54.5	1.99	33.3
Russet Burbank	26	5.15	46.2	0.93	11.5
Red McClure	5	8.48	100.0	1.46	40.0
White Rural	3	2.47	66.7	0.00	00.0
British Queen	1	6.67	100.0	0.00	00.0
Late Rose	1	0.00	00.0	0.00	00.0
Total and Average..	143	7.07	66.4	2.44	35.7

amount of bruising found in chain groceries with that found in independent groceries and fruit and vegetable stores. This comparison is shown in table 9. There was considerably less bruising in the potatoes found in the independent groceries than in the other two types of stores. This is probably caused either by the fact that the independents handle their potatoes more carefully, or that they sell a higher proportion of varieties that are less subject to bruising. At the Northern Ohio Food Terminal where potatoes are sold mainly on a jobber's market it is commonly said that fresh produce going into the independent groceries is handled more roughly than that sold by the chain groceries and the fruit and vegetable stands. This is not evident so far as potatoes, that are referred to in table 9, are concerned.

TABLE 9.—*Relation of type of store to bruising of potatoes in Cleveland market. 143 samples—March and April, 1936*

Type of Store	Number of Samples	Damage		Serious Damage	
		Average Per Cent	Per Cent of Samples	Average Per Cent	Per Cent of Samples
Chain grocery ...	76	8.32	73.7	3.30	42.1
Independent grocery	44	4.13	50.0	1.19	25.0
Fruit and Vegetable	23	8.59	73.9	2.42	34.8
Total and Average	143	7.07	66.4	2.44	35.7

TABLE 10.—*Effect of handling on tuber bruising in Cleveland market*

Maine Green Mountains in 100 lb. bags, November, 1936

Car No.	Bruised but Not Damaged Per Cent			Damaged Per Cent			Seriously Damaged Per Cent		
30 Pound Samples	Car	Store	Increase	Car	Store	Increase	Car	Store	Increase
I: 9 samples ..	26.20	36.27	10.07	4.47	19.51	15.04	3.51	8.54	5.03
II: 5 samples .	37.63	66.04	28.41	5.00	8.83	3.83	0.50	5.83	5.33
III: 5 samples.	36.17	60.54	24.37	2.71	19.75	17.04	1.04	14.29	13.25
Average 19 samples ..	31.78	49.94	18.16	4.15	16.65	12.50	2.08	9.28	7.20

(All percentages on weight basis).

Inasmuch as the damage from bruising found in these retail stores averages so much higher than that recorded at shipping points, an attempt was made in November 1936 to determine how much damage actually resulted from the time certain carlots were unloaded until they were offered for sale in the stores. In three cars of Maine Green Mountains nineteen samples of thirty pounds each were examined for damage from bruising. These samples were replaced in the 100-pound bags from which they came and the bags were tagged for later identification. By arrangement with one of the large grocery chains, to whom these cars were consigned, thirty pound-samples from each of these same bags were again analyzed after they had been dumped into the store bins. Since the car inspection for bruising, these potatoes had been unloaded from the car, trucked to and stacked in the warehouse, reloaded on trucks, unloaded at the store and dumped in the store bin. The increase in bruising is indicated in table 10.

In the analysis of these samples the bruised tubers were weighed in three classes, namely: those bruised but not damaged, damaged, and seriously damaged. Although in the store samples the tubers bruised but not damaged, were increased nearly sixty per cent by weight, both the damaged and the seriously damaged weights had increased four times more than those found in the car. The data in table 10 may be compared with the percentages of damage and serious damage in the forty-one samples of Green Mountains in table 8. Although the latter average is somewhat lower, the ratio of damage to those seriously damaged is about the same. It must be concluded from this study that not only is mechanical injury the most serious defect in potatoes marketed in Cleveland, but also that more than half of the injury results from the present methods of handling after they arrive on track.

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REPORT ON POTATO VIRUS DISEASES IN 1936

T. P. Dykstra

Associate Pathologist, Division of Fruit and Vegetable Crops and Diseases, United States Department of Agriculture, Washington, D. C.

This report has been prepared without making an attempt to compile a complete summary of potato virus research during the past year, but the papers dealing with timely and general interest have been reviewed and the principal conclusions derived from them are presented.

Smith's (26) book on plant viruses gives an accurate account of the more important characters and properties of plant viruses. It covers the general technique of plant virus study, natural modes of transmission, the virus in the host, the virus in the insect vector, immunity, nature of the viruses and classification, control, and some comparisons between the plant and the animal viruses.

Cook (8) has published a host index of virus diseases of plants. This is an attempt to compile records of each disease. Up to the present, virus diseases have been recorded on approximately eighty families, more than four hundred genera, and nearly one thousand species of plants.

Cook (9) has also issued an index to the insect vectors of virus diseases. The insects are listed alphabetically, and the host plants affected are cited.

Otero and Cook (18) have issued a supplement to a partial bibliography of the literature of plant virus diseases.

Schultz and Raleigh (24) state that the latent mosaic potato virus has been shown by means of inoculation on *Datura stramonium* to fall into four types, namely, faint, medium, severe and virulent. Inoculation on Green Mountain with a complex of mild mosaic and severe latent causes distinct mottling and ruffling, whereas mild mosaic and faint latent induce the former symptoms only, and mild mosaic alone results in a slightly paler green and rugose foliage. These data indicate that different groups of viruses are responsible for mild and latent mosaic and that distinct pathological manifestations arise from inoculation with virus complexes of various types.

Köhler (12) found that potato ring mosaic may be divided into two types, namely: potato ringspot and mottle virus, of which the latter is characterized by a superior degree of thermostability. Each

type comprises strains of varying virulence. The ringspot is the more virulent of the two types.

Bawden (1) gives details of experiments with Salaman's S strain of the virus X, which is serologically indistinguishable from the G and L strains. Inactivation of the virus by heating the suspension at approximately 66° C., by ageing, *in vitro,* or in 85 per cent alcohol was accompanied by the loss of flocculating power with antiviral sera. Formalin inactivated the suspension but left the flocculating power unimpaired. Bawden and Pirie (3) made a study to determine the effects of certain enzymes on purified suspensions of the S strain of potato virus X. They found that the virus was inactivated after eight hours of contact with a 0.15 per cent solution of pancreatin at pH 7 and at 38° C. Trypsin immediately reduced the infectivity of the virus. Neither papain nor cyanide alone exerted any effect on the virus, which was inactivated by a combination of the two at pH 4.0. These results are highly suggestive that virus X is protein in nature.

In a later paper Spooner and Bawden (27) report that the saps of tobacco, *Nicotiana glutinosa* and *Datura stramonium* infected with virus X contain a common antigen. The investigations indicated that the virus antigen is specific to the potato virus X as it was not found to be present in the sap of tobacco infected with the other potato viruses studied. No antigenic differences were found among the different strains of the X virus.

Dykstra (10) found that when grafts of healthy Green Mountain, and occasionally also of Bliss Triumph and Earliest of All were made to the English varieties, Arron Victory and President, a top necrosis developed. This could not be attributed to the X virus, the latent virus of healthy commercial varieties, which produces in these varieties only a mosaic type of mottling. Grafts from the English variety, Up-to-date, a carrier of virus B, and usually accompanied by virus X, on Arran Victory and President also produce top necrosis. When grafts of Up-to-Date were made on U. S. Seedling 41956, resistant to the X virus, the streak-producing B component of Up-to-Date is retained to the exclusion of X. It is believed that the B virus reported from England is also found in some of the commercial healthy potatoes in this country, which act as carriers of this virus.

In Russia (30) mild mosaic is generally quite severe in Centifolia and Great Scott varieties. Losses of 20 to 65 per cent at harvesting were attributed to this source. Crinkle is widespread and

severe. Constantin (7) gives a discussion of potato culture in Morocco. The crop is grown by the natives exclusively in mountainous regions at an altitude of 2,400 to 5,000 feet above sea-level. Not a sign of degeneration has been observed although the same seed had been used for indefinite periods.

Stewart (28) reported that a grower in New York succeeded in controlling virus diseases for nine consecutive years (1924 to 1932), the total incidence of virus diseases (mosaic and leafroll) in Green Mountain detected at two inspections in the latter year being 0.4 per cent compared with 2.6 per cent in the former. These results were attributed to the tuber unit method of planting, early and thorough roguing, in plots located where temperatures are rarely high, and aphids seldom plentiful.

Muncie (16) states that yellow dwarf was first recognized in Michigan in 1927, and is now of considerable importance in the State, where the losses from this source are frequently 15 to 25 per cent of the crop and in some cases may involve a reduction in yield of 75 to 90 per cent.The affected plants range from 3 to 12 inches in height and have slightly thickened, brittle, yellowish foliage attached at an acute angle to the thickened stem. In severe cases the leaves are small and slightly curled, and the somewhat unusually dark green of the early stages is in turn manifested by a gray-green, dull yellow, and brown discoloration, similar changes taking place in the stem. On the larger plants, the first signs of the disease are yellowing and dying of the axillary buds near the tip of the stem or the pinching and marginal bronzing of the apical leaflets; later the yellowing extends to the older leaves. In large plants with two or three stems arising from a single tuber, only one may show distinct yellow dwarf symptoms, but all the tubers from such a hill may produce diseased plants. A brown flecking of the pith at the growing tip of the stem, sometimes extending downward and being most conspicuous at the nodes, is a marked feature of the disease. Several diseased plants produce small, misshapen, often cracked and spotted tubers closely attached to the stem. Yellow dwarf occurs in the most virulent form in light, sandy soils during seasons of high temperature and low precipitation. At 60° to 70° F. the symptoms of yellow dwarf in greenhouse plants were largely masked, developing in an acute form only on the raising of the day and night temperatures from 75° to 90° and 60° to 75°, respectively. Details are given of experiments in the transmission of the yellow dwarf virus by various methods, of which tuber grafting and insects,

especially *Empoasca fabae* and *Macrosiphum solanifolii,* proved the most effective. The clover leafhopper *Aceratagallia sanguinolenta,* found to be an active carrier of yellow dwarf, occurs in abundance in Michigan in potato, clover and lucerne fields, and the rapid spread of the disease may be, in part, attributed to the regular cultivation of lucerne over considerable areas in close proximity to potatoes. In Wisconsin (23) yellow dwarf of potatoes was effectively combated by the use of certified seed.

Black (4) also found the clover leafhopper, *Aceratagallia sanguinolenta,* to be a vector of the potato yellow dwarf virus, and collected viruliferous insects from clover fields. The medium red clover, *Trifolium pratense,* is susceptible to the virus, and is the chief host plant of the clover leafhopper. The hoppers are able to transmit the virus about nine days after feeding on diseased plants and are capable of harboring the virus from early November until early April. Black was unable to secure infection by means of *Myzus persicae, Macrosiphum solanifolii* and *Empoasca fabae.*

Typical leafroll has not been detected in South Africa according to Pullen and Wasserman (20). An apical leafroll occurs fairly generally. It causes a rolling of the basal portion of the smaller leaflets on young leaves, the terminal growth is checked, and the lower shoots are stimulated, giving the plant a pyramidal shape. The leaves develop a reddish or purplish color and the tubers are reduced in size.

Magee (14) reported that spotted wilt, a virus disease, caused considerable damage on potatoes resulting in 10 to 50 per cent infection. Numerous circular, brown, frequently zonate, necrotic areas develop on the upper leaves and longitudinal dead lesions on the stem. In addition, some of the tubers show brown areas in the flesh, growth is arrested and yields reduced.

Porter (19) demonstrated that the potato aphid (*Macrosiphum solanifolii*) is a vector of calico. This disease was transmissible by mechanical inoculation to tomato, pepper, eggplant, Jimson weed and petunia, and to many varieties of potato.

Loughnane and Clinch (13) state that the interveinal mosaic in Ireland results from the combined action of two different viruses. One component is a virus of the X type, whereas the other produces on President foliage a slight, transient mottle, but in the cortex and pith of the tubers irregularly distributed necrotic blotches. It is regarded as responsible for the latter symptom in interveinal mosaic.

The virus appears to be related to, or identical with, that causing phloen parenchyma necrosis or pseudo-net necrosis.

Putnam (21) found that the President variety has for a number of years been observed to suffer from a complex mosaic of which two of the three components appear to be identical with the vein-banding and mottle viruses found in rugose mosaic; the third, producing the typical yellow mottle associated with the disease, does not seem to have been reported previously. It belongs to the X group, is filterable and transmissible by the sap of infected plants, but not by the aphid *Myzus persicae*, is fairly resistant to ageing and chemical action, and has a thermal death point of about 72° C.

Dykstra (11) compared some European and American potato viruses on a number of European and American potato varieties. The X virus was found to be similar to the so-called latent virus of healthy American commercial varieties. The Y virus and the vein-banding virus belong to the same group, but are not identical. Para crinkle does not resemble leafrolling mosaic, or any other known potato virus disease. Crinkle A is not identical with rugose mosaic, but resembles mild mosaic, although the mottled pattern is somewhat different and the crinkling of the leaves is less severe than that caused by mild mosaic on the same varieties. Virus C produced a severe top necrosis as current season symptoms on all the American potato varieties tested. This virus does not resemble any of the known potato viruses in this country.

Bawden (2) found that top necrosis can be produced by viruses A. B. C. D. and X in different potato varieties. The same virus may produce foliar necrosis in some varieties, and mottling in others. Failure to appreciate the fact that the same virus may produce varying symptoms on different varieties has resulted in numerous names being given to the same virus, and similar names to different viruses, merely because different workers have used other varieties.

Botjes (5) discusses immunity in relation to virus diseases of plants, with reference to the current studies on the subject in Europe and the United States under the following headings: Selection of attenuated virus strains, whether such strains are produced spontaneously under given environmental conditions or by selections from already existing strains; acquired immunity; the range of immunity from specific virus diseases; and observations in connection with the question of immunity from virus diseases in Holland.

Schultz and Raleigh (25) found that a healthy Katahdin tuber and shoot, grafted on the latent mosaic Green Mountain variety, develop

foliar and tuber necrosis. The tuber progeny of the necrotic shoots develop plants manifesting different stages of necrotic symptoms; some of the shoots may be severely necrotic, whereas mottled Katahdin shoots grafted on latent mosaic Green Mountain develop mottling and mild necrosis. Healthy Katahdin shoots grafted on mottled Katahdin develop mottling and a few necrotic spots. Since the mottled and mildly necrotic Katahdin fail to develop severe necrosis on subsequent grafts on latent mosaic Green Mountain, it appears that mottled Katahdin has acquired resistance to latent mosaic.

Raleigh (22) found that Green Mountain scions infected with latent mosaic (X virus) develop aerial tubers, rolling of the leaves, and marked stunting when grafted on healthy U.S.D.A. seedling 41956, known to be resistant to latent mosaic. This reaction was also obtained when a Green Mountain seedling was inoculated with latent mosaic after the grafts were made. A similar abnormal reaction has been observed in grafts of mild mosaic Green Mountain scions on Irish Cobbler stocks, which are known to be somewhat resistant to mild mosaic.

The results indicate, that the general principle of grafting infected scions on potatoes to determine their reaction to the virus diseases concerned may be of much value in studies on resistance to viroses.

Stone (29) showed that mosaic potato plants (Green Mountain) tended to produce more leaves than the normal, but the total leaf surface was less, because of smaller size of the leaves. The green weight per unit area of the leaves was inversely proportional to the degree of severity of the disease, but dry weight in mosaic plants per unit area was greater than in the normal plant. The ash content was lower in normal than in mosaic plants, but taken in proportion to the dry weight of the roots of normal and diseased plants, it only indicated a slight reduction of the absorbing capacity of the roots by mosaic. The whole work is interpreted to demonstrate that the carbon-fixing apparatus does not function so efficiently in the mosaic as in the normal plants.

Claridge (6) reports on potato certification in New Zealand. It consists of two phases (1) provisional certification, merely showing that the growing crop after inspection for diseases and varietal purity has been found satisfactory, and (2) final certification after examination of the produce from a provisionally certified crop. Provisionally certified seed may be sold, but without guarantee, other than the word of the vendor, whereas every sack of certified seed bears an official tag.

Marchionatto and Millan (15) give a brief explanatory account

of the introduction of quarantine legislation for the exclusion of potato diseases. Three inspections are made of all plantings registered for certification, (1) at flowering, (2) before maturity, and (3) during harvest. At (1) the limits of tolerance in respect to the various diseases are up to 5 per cent for mosaic and yellow dwarf. Seed plots must be isolated. Health certificates are supplied for consignments of seed potatoes to foreign countries.

O'Brien (17) reports on the certification scheme of the Scottish Department of Agriculture. The first official inspection of the growing crops is generally made towards the end of June or early in July, the second in August; and the third in September. Varieties must be over 99.5 per cent pure to obtain a T.S. (True Standard) certificate for an immune variety, or an N.I. certificate for a non-immune variety. At the same time they must be comparatively free from virus diseases, and if in addition to being pure, they are also up to the required standard in health, a further certificate, T.S. (H) (true standard healthy) or N.I. (H) is granted. A special stock seed certificate, S.S., is given to especially pure and healthy varieties. In building up stocks for seed the usual practice is to select one or two healthy plants having the varietal characteristics well developed. The progeny of such plants is grown in isolation and any plant suspected of virus infection is uprooted before it has time to infect others. During an official inspection a stock seed certificate is not granted if it is evident that over 10 per cent of the plants have been removed by the farmer before the inspection.

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RESISTANCE OF THE POTATO TO LATENT MOSAIC

E. S. Schultz, *Senior Pathologist*, C. F. Clark, *Horticulturist*, F. J. Stevenson, *Senior Geneticist, and* W. P. Raleigh, *Associate Pathologist, Division of Fruit and Vegetable Crops and Diseases, United States Department of Agriculture, Bureau of Plant Industry, Washington, D. C.*

Resistance studies have shown that certain varieties are immune from latent mosaic; others rarely contract infection from field exposure but become infected in tuber and shoot grafting; whereas still others are masked carriers of this disease (1), (2).

This paper presents information on the reaction to latent mosaic

of potato seedling varieties from two crosses, S 41956 X Katahdin and S 41956 X S 45075.

Latent mosaic comprises a potato virus group involving virus types distinguishable by differences in virulence or severity of reaction on potato, tobacco and Jimson weed. Furthermore, it has been shown (3), that potatoes inoculated with different types of latent mosaic in combination with a virus of another group, such as mild mosaic, manifest different mosaic symptoms. Moreover, potatoes harboring the latent mosaic virus are subject to more severe reactions if they contract other viruses. Although latent mosaic virus alone may induce slight, or no apparently pathological reactions on certain varieties, it may cause severe reactions in composite infections.

The seedling variety 41956, a progeny from the cross G.S. 9-1 X S 24642, was first found to be immune from latent mosaic in tuber grafting with potatoes infected with rugose mosaic (latent, veinbanding) and mild mosaic viruses. In these grafts this seedling variety contracted only the veinbanding virus, and the mild mosaic component free from the latent virus. In many stalk and tuber grafts and sap inoculations with latent mosaic it has failed to become infected as was disclosed by sub-inoculations to *Datura stramonium* and *Capsicum* sp., which readily contract latent mosaic from sap inoculations (1).

Raleigh (4) found that scions of a Green Mountain seedling containing the latent mosaic virus developed aerial tubers, and dwarfed shoots when grafted on stocks of 41956. Tubers failed to form on the latter. The development was normal, however, in grafts where Green Mountain seedling scions, free from latent virus, and stocks of 41956 were used.

This aerial tuber reaction provides a method for detecting immunity of the potato from latent mosaic. This method, and using *Datura stramonium* and *Capsicum* sp. as index hosts, was employed in determining the reactions of the seedlings as recorded in table 1.

TABLE 1.—*Reaction of potato seedling varieties to latent mosaic in stem grafts to latent mosaic Green Mountain*

Parentage	Seedling Varieties	Reaction of Seedling Varieties			
		Immune	Necrotic	Mottled	Latent
	Total Number	Per cent	Per cent	Per cent	Per cent
S 41956 X Katahdin.	203	37	23	16	24
S 41956 & S 45075...	135	37		36	27
Katahdin control	6		100		
S 45075 control	4			25	75
S 41956 control	10	100			

The results recorded in table 1 were obtained by inarch grafting of a shoot from each of three tubers of a seedling variety on a latent mosaic Green Mountain shoot when the plants were about 15 cm. high. Approximately 10 days after grafting, the seedling shoots in two of the grafts were cut off above and adjacent to the graft union, whereas the Green Mountain shoots were cut off below the graft union so as to leave a latent mosaic top on the seedling variety stock. The seedling shoots in the third graft were not severed so that the foliage reactions could be observed. Four weeks after inarching, seedling plants were recorded as immune, (where aerial tubers formed on Green Mountain shoots); necrotic, mottled or light green foliage; and latent, (with no apparent symptoms). Sap inoculations were made from apparently healthy seedling plants on *Datura stramonium* and *Capsicum* sp. to determine whether such seedlings were symptomless carriers of the virus. The final observations were made at harvest time, eight weeks after inarching, when some of the grafted shoots that failed to manifest symptoms at the previous inspection, were found to show reactions.

Inarched grafts of Katahdin, and of the seedling varieties 41956 and 45075, the parents used in the two crosses, were made on latent mosaic Green Mountain to serve as controls. The results showed that all the Katahdin shoots developed top-necrosis. One shoot of 45075 developed light green foliage, whereas three remained apparently healthy, but inoculations from these last shoots to *Datura stramonium* showed that these plants harbored latent mosaic. The seedling variety 41956 was immune, as was indicated by the aerial tuber reaction in the latent mosaic Green Mountain scion.

As recorded in table 1, the seedling variety progenies reacted as follows: Of the 203 from S 41956 X Katahdin 37 per cent were immune; 23 per cent necrotic; 16 per cent mottled with light green foliage; and 24 per cent were apparently healthy. Of the 135 seedling varieties from S 41956 X S 45075, 37 per cent were immune from latent mosaic; none developed necrosis; 36 per cent manifested mottled and light green foliage; and 27 per cent appeared healthy. Sap inoculations from the apparently healthy progenies in the two crosses on *Datura stramonium* and *Capsicum* sp. showed that the apparently healthy plants harbored latent mosaic.

Thirty-seven per cent of the progeny of both crosses showed immunity from latent mosaic (table 1). Twenty-three per cent of the progeny of S 41956 X Katahdin developed the same top necrosis reaction to the disease as is typical of the Katahdin parent. No necrosis developed in the progeny of S 41956 X S 45075, which indicates that

the S 45075 parent is genetically different from Katahdin for this type of reaction.

Although the data at hand are not sufficient to permit a complete genetic analysis of the various reactions, the results show that immunity from latent mosaic of the parent S 41956 was transmitted to a high percentage of the progeny of the two crosses.

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SECTIONAL NOTES

Alabama

Alabama has planted the largest acreage in its history One hundred and fifty-nine cars of seed potatoes were planted in 1936, and approximately three hundred cars have been planted for the 1937 crop. The acreage, therefore, in South Alabama will be approximately double that of last year and about 50 per cent increase over a long period average. The crop is in excellent shape, and the general attitude of the growers is optimistic. (April 8).—L. M. Ware.

California

We conducted a private survey of the Kern County potato district, listing each grower by acreage. The sum total of this estimate showed that in Kern County 22,500 acres of potatoes were planted. A small additional acreage will be planted after this estimate was made.

The California Department of Agriculture is estimating the acreage for this district at 20,100. However, we believe that a final check-up will prove that the acreage is nearer 23,000. In the Edison district, which is included in the above totals, there are 3,600 acres. Part of this acreage was planted very early and will start producing in a small way about April 15. However, the real production in Kern County will not

start until approximately the 20th of May and a real heavy production will be experienced during the month of June.

During the last two weeks in March climatic conditions were not favorable for quick and vigorous growth for potatoes in the entire Kern County district. For this reason, the maximum movement will not take place so early as most people think. However, this condition will have very little material effect on the total quantity produced, and if the district does as well this year as it did last year, the total shipments will amount to 18,000 or 19,000 car loads of potatoes. These will have to move during a period of fifty days, which means that if the Kern County area is to sell all of its potatoes, they will have to sell at the rate of nearly 350 cars daily. The normal sure outlet for these potatoes amounts to something less than 100 cars each day; however, a disastrous frost which occurred during the month of April, when the potatoes were half formed, might change this picture entirely.

The acreages in the remaining districts in California are almost normal. There has been a slight expansion in San Diego, Riverside, and Los Angeles, but the increase is inconsequential. The Stockton district acreage will be curtailed compared with last year and all previous years, and planting operations have just begun. What will happen in the Tule Lake district in the northern part of the state is yet an unknown matter. However, if there is no material increase in Tule Lake, the acreage in California, exclusive of Kern County, will be very close to what it was last year. The increase in California took place almost entirely within Kern County. (April 5)—H. G. Zuckerman.

Colorado

A five per cent increase in acreage is expected in Colorado if history repeats itself. However, there will probably not be any increase in production, as supplies of good seed have been exhausted for a long time, and high prices have led growers to sell all marketable potatoes in many cases.

With seed potatoes considerably inferior, in general, to those planted last year, yields may be expected to be somewhat lower. Many potatoes will also be planted on marginal potato land, and some abandonment is to be expected.

Early potatoes are now being planted in the Gilcrest, Fort Morgan, Brush, Fruita, and Montrose Districts. There is some increase in the acreage of early potatoes planted. The late crop will not be planted until May and will continue until the latter part of June.

Recent heavy snows have brought snow fall in the mountains to normal or above, and the prospects for water for irrigation are excellent. These same recent snows have also soaked the ground thoroughly, and conditions should be ideal for planting in all sections of the state. (April 10).—C. H. Metzger.

Indiana

At the present time it is rather difficult to say what our acreage in Indiana will be this year, because of the high price of seed and the scarcity of good seed. From present indications it is anticipated that approximately 60,000 acres will be planted.

Early potatoes have been planted in the southern counties for approximately two weeks and most of the growers in the lower portion of the state will have their potatoes planted by the 15th of this month, with the growers on muck soil planting some time between the 15th of April and the 15th of May. They, however, must wait until the danger of frost is over before any planting can be chanced upon the muck soils. A number of our growers have from 150 to perhaps 3,000 or 4,000 bushels of potatoes on hand, and I imagine a large portion of these will be used for seed purposes, although we highly recommend good northern-grown certified seed. (April 6).—W. B. Ward.

Iowa

There is still frost in the ground under heavy grass or in sheltered places. So far as we know, practically no potatoes have been planted, although March is the proper planting date for southern Iowa. The period between cold weather and summer heat is going to be short and will probably reduce the crop. The only thing that can prevent this will be a cool summer.

We understand that conditions are similar, even as far south as the Kaw Valley in Kansas and the Orrick district in Missouri.

The seed supply is short and high-priced and much of it is not in good shape. Although this is exclusively an early potato region, some of our people are planting Russet Rurals brought down from northeastern Minnesota, northern Wisconsin, and from northern Michigan by truckers. We have also had seed Cobblers from Maine. The prices on seed potatoes, from rather poor looking common selected seed to the best of certified seed, ranged from $3.00 to $3.85 or even $4.00 per 100. Apparently the acreage planted is going to be about the same as in previous seasons.

This season we shall again have index and yield tests of registered and certified seed potatoes, mostly Cobblers, on the Sam Kennedy farm at Clear Lake. The varieties in these plots this year will consist of lots from North Dakota, from the Arrowhead district of northern Minnesota, from the Antigo-Rhinelander Cobbler-growing region of northern Wisconsin, and from Prince Edward Island. The seed for these plots is cut exactly one-tenth pound in size, is spaced precisely twelve inches apart in the rows, and 50 seed pieces are planted in each of the five replicas. These plots are always indexed in June and the yields taken in the autumn. As a result of this work about 1380 sacks of registered seed have come into Iowa for planting in 1937. Mr. W. A. Hendrickson of Estherville, recent past-president of the Iowa State Vegetable Growers' Association, and his associates secured 480 sacks of registered seed; the entire offering of Louis Torgerson of Fosston, Minnesota, and Dan Felsing and Sons of Laurens have purchased 900 bags from the vicinity of Virginia, Minnesota, all registered stock. The growers on the great marsh at Hollandale, Minnesota, bought several car loads of Prince Edward Island seed, for which they paid $4.00 a hundred.

An inter-state tour for the inspection of the index plots, the plantings of registered seed, and the windbreaks above mentioned is planned for the northern Iowa, Hollandale district, on the 29th and 30th of June. (April 6).—C. L. Fitch.

Kentucky

As a whole, Kentucky has increased its acreage to 1,000 above that of 1936; at present we have approximately 48,000 acres.

The commercial acreage about Louisville is reduced 25 per cent below that of 1936, and at present we have 6,000 acres. Contributory to this reduction was the loss of seed through the Ohio River flood.

The commercial acreage about Lexington has been reduced 100 acres, leaving an acreage of 800. This is regarded as a wholesome readjustment to outlet, practically the entire output moving through two chains of stores which have re-arranged their distribution areas.

The new acreage issues partly because of shifts from tobacco, and partially as a result of distilleries acquiring farms on which livestock is being fed mash and brewers' grains.

Planting is practically completed. Conditions are exceptionally good. There is an average gain in earliness of approximately three weeks compared with last year, since, on the first of April, less than 40 per cent of the seed were in the ground. (April 1).—John S. Gardner.

Louisiana

There has been a number of factors which have adversely affected the prospects of the potato crop; namely, some lots of poor seed, unusually heavy rainfall, and intermittent cold. Certain lots of uncertified seed showed as high as 50 per cent diseases. Some sections received 10 inches of rain in twenty-four hours during March. Freezing and nearby freezing temperatures during three periods in March caused varying degrees of damage to potatoes and also retarded the growth of the crop.

In addition to reducing the prospects for yield there will be a delay of ten days to two weeks in the movement of the crop.

The peak movement may not be reached until approximately between the 15th and 20th of May. However, there may be some scattered loadings in the earlier section during the latter part of April.

Several loading points are setting up potato washing and drying equipment.

The state and parish potato tours now being conducted are being attended by a large number of northern seed potato interests from several of the states from which Louisana growers buy their seed. (April 13).—J. G. Richard.

Maryland

Maryland potato growers located at elevations below 1,000 feet above sea level, have planted their early potato crop. Despite the scarcity of home-grown seed and the high price of seed from other sources, the acreage was increased approximately 5 per cent above the 1936 planting. Approximately half the crop was planted with home-grown certified seed, and the other half with seed from other sources, mostly Maine certified seed. The Irish Cobbler variety was used for the major portion of the crop, and because of promising results with other new early and medium-early varieties, a small acreage was planted with the Katahdins, Chippewas and Warbas. Since recent experiments have shown that home-grown seed can be made to germinate and mature as early as northern-grown seed, much of the home-grown seed was kept at temperatures of 50° to 65° F. after the middle of January, at which time the rest period had terminated. (April 10).—R. A. Jehle.

Nebraska

Nebraska growers do not plant potatoes for the main crop until approximately June 1. A very small amount of early crop will go

into the ground during the latter part of April, but this is a very fluctuating matter.

Owing to the severe drought conditions of 1936, many potato growers are discouraged and their planting intentions are being curtailed greatly. The dry land crop, which constitutes 90 per cent of our certified acreage, will be cut very severely. The present indications are that many sections will experience a reduction of at least 50 per cent. The shortage of seed is one main factor which causes this situation. A general shortage of all crops this past season, is also responsible, as the growers are unable to pay the high prices demanded for seed.

Growers in the irrigated sections will increase the acreage slightly, owing to the fact that they had a very successful season both with the commercial and certified potatoes. The bulk of the commercial crop sold at prices ranging from between $2.25 and $2.50 cwt. f.o.b. cars, shipping points. Certified potatoes ranged from $3.25 to $3.50 cwt. f.o.b. shipping points. The majority of the shipments consisted of the variety Bliss Triumph, with a few Irish Cobblers.

The final shipments of certified potatoes were about the lowest in ten years. One hundred cars of dry-land potatoes were shipped from the 4200 acres harvested. The irrigated stock shipped amounted to 250 cars which were harvested from approximately 1200 acres. Our original acreage entered for Certification totaled 10,000 acres, and the total harvested was 5,400. This is a very sad picture, but it shows the results of the extreme drought of last season. Most of the acreage loss was on dry land, although to a certain extent, it affected some irrigated sections this season.

Shipments for this season have practically ceased, and the majority of the present movement is local seed sales.

Our crop prospects for this coming season, are better than they were a year ago at this time. We have had a fair snow fall, and the available moisture in the soil is more than it was last year. Because of the fact that we still do not have an ample supply of moisture in the ground many growers are holding down on planting intentions. If there should happen to be ample moisture during the spring, we feel that there would be a spurt in the local seed sales and possibly quite an increase in prices. (April 15).—Marx Koehnke.

New York

Intentions to plant indicate that the potato acreage will be increased only slightly in New York this year. The table stock market has been,

and still is, draggy, as many growers are inclined to hold for better prices. The New York Cooperative Seed Potato Association at Georgetown, reports a supply of certified seed of both standard and new varieties still on hand for sale. This Association is recommending the Chippewa variety highly as of much promise to New York growers. On the contrary, Golden is classed as a novelty so far as its adaptation to our conditions is concerned. Katahdin is in demand as a chip potato but for many growers its yield has been disappointing.

Variety testing will again be conducted extensively this year. Seed of all the new and standard varieties is being distributed to nearly 20 counties for planting, under supervision of the Farm Bureaus.

The joint committees of the Empire State Potato Club and the State Farm Bureau Federation will meet at Ithaca on April 14 to review the potato research work being conducted and to discuss plans for 1937. Roy A. Porter of Elba who is president of the State Potato Club, is also doing a fine job as state chairman of the Agricultural Conservation Committee. (April 14).—E. V. Hardenburg.

Pennslyvania

The certified seed crop in Pennsylvania moved out earlier this year than usual. The bulk of the shipments has already been made at prices to the grower at the farm that netted from $1.80 to the bushel for Russets to $2.00 for Cobblers.

Several car loads of Pennsylvania-grown Bliss Triumph seed were shipped to Florida last fall. Reports received on this seed through the season indicated good stands of thrifty plants, good yields and results that were entirely satisfactory to the southern planters. Several planters reported estimated yields of 300 bushels to the acre. So far as we know, this was the first Pennsylvania-grown Bliss Triumph seed stock shipped to Florida for planting purposes. We hope to develop an outlet for a considerable volume of Pennsylvania-grown seed to the southern planters. As a result of the few car loads of seed that were shipped south last fall, we anticipate a sizable increase in the acreage of Bliss Triumph entered for certification in 1937. Last year there were only 37.5 acres of this variety entered for certification. There will probably be approximately 200 acres entered this year. Our growers are anticipating an outlet for at least 25 cars of Bliss to the Florida trade before the end of the year. This seed is being grown in Potter County which, growers feel, is an ideal area for the growing of seed potatoes. Seed shipped from this section in past years has

been giving very satisfactory results. It is felt that Potter County Pennsylvania-grown seed planted in Florida will give as satisfactory results to southern planters as it has in past years to Pennsylvania growers.

The demand for certified russets was very good this spring although the trend toward Cobblers is still quite marked, especially in the southeastern counties. From reports received, growers in this section are increasing their acreage devoted to Cobblers. A number of large growers, who grew Russets last year, is planting a considerable acreage of Katahdins this year.

Nearly all the table stock has been moved, although a few growers still have their cellars full and are holding them for a price advance which they anticipate will come during April or early May. (April 5). —K. W. Lauer.

Our state crop reporting service gives an estimated intention to increase the potato acreage five per cent. With the exception of a few plungers and the usual "in-and-outers," I have not heard of much increase in the regular commercial acreage. The high price of seed is, of course, a deterrent. Most growers are fairly well sold out, the price has been satisfactory and the crop has moved without difficulty.

The State Association's marketing program worked with apparent satisfaction, but it was easy to sell ungraded or poorly graded stock. There was less trouble with odd shapes than usual and the market was so strong that there was no rush on the part of the growers to take advantage of it. This year will probably give it a better trial.

In spite of the relatively mild winter, potatoes seem to have kept well. In some storages one of the main troubles was caused by field-frosted tubers, the symptoms of which were not apparent when stored. (April 10).—J. B. R. Dickey.

South Carolina

The acreage this season has been estimated at 15,000 acres as compared with 10,000 last year, but the yields will probably be somewhat lower than in 1936. This is because of the fact that we had a heavy frost on the 27th of March which killed many fields of potatoes to the ground. I would say that yields of No. 1 potatoes will be reduced about 10 per cent where the plants were badly frosted, and that the crop will be approximately a week later than last year.

At the present time the potatoes are growing nicely and in approximately a week nearly all fields will be normal again, the plants having outgrown the effects of the frost. We have had sufficient rain-

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fall to date, and there has been no evidence of any serious diseases. The first potatoes will probably be harvested between the 15th and the 20th of May. (April 3).—J. M. Jenkins, Jr.

Texas

In the Rio Grande Valley the early Irish potato crop is about ready for harvest, and a few truck loads have already begun to move to market.

There has been some deterioration of the crop because of diseases, but a fair yield is anticipated. The Eagle Lake-Sugarland-Wharton area has been somewhat retarded by the recent cold weather with slight damage to plants in certain areas. At this time it is impossible to determine definitely the probable yields for this section. (April 7). —J. F. Rosborough.

Vermont

According to the U. S. estimate of intentions to plant, Vermont will have 18,000 acres in 1937. This compares with something more than 16,000 last year which was close to the average for 1928-'32. Whether or not the continuation of a low price market will reduce actual plantings remains to be seen. Since most of the planting is done in Vermont during the latter part of May and the early part of June, there is ample time for growers to change their minds either way. It is quite possible that the present low price of milk may be an influence in intentions to plant an increased potato acreage, for most Vermont potato growers are also milk producers.

The noticeable trend in Vermont certified seed growing is toward the reduction of Cobbler acreage. Large quantities grown elsewhere, with the consequent establishment of a low price in fall, is the partial answer.

The large number of inquiries coming to the office of the Vermont Certified Seed Potato Growers' Association in response to mention of Early Rose in farm papers, indicates that there is still a place for this old time variety, especially among growers for home use. The large number of inquiries regarding the Chippewa has also been noteworthy. Interest in these two, representing just about the alpha and omega among modern potato varieties, seems to show that many people are looking for fairly early varieties in addition to the Cobbler.

Vermont certification rules for 1937 will continue unchanged on the American Potato Association basis. (April 5).—Harold L. Bailey.

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Virginia

The white potato planting on the Eastern Shore of Virginia is now completed. Definite information regarding the acreage increase is not yet available, but the indications are that there will not be less than 10 per cent increase above last year's planting.

The planting season was somewhat early in the lower half of the Peninsula, but because of the cold and dry weather, growth has not been rapid, and the planting was delayed in the northern half of the area until the planting season ended at approximately the normal time.

The weather was dry until the 5th of this month, when a good rain fell, after which growing conditions improved. At the present time there is no reason to believe that the harvesting season will vary much from the normal. Conditions from the present time will determine any variations from the normal.

It is currently reported that the Norfolk and North Carolina sections have increased their acreage at least 40 per cent, and South Carolina and the more southerly Atlantic Coast districts at least 50 per cent. Growth has been good in the southern areas, and an early harvest is indicated until South Carolina is reached. The recent frost injured the tops severely and apparently will retard the harvesting season by, at least, a week or ten days, under the most favorable conditions. (April 8).—G. S. Ralston.

Washington

Present indications in the state of Washington suggest an increase in planting in both seed potatoes and the commercial potatoes of approximately 35 per cent. It is probable that the increased planting will be larger in the early varieties than in the late varieties. Old stocks of both the seed and commercial potatoes are mostly out of the hands of growers. As a matter of fact, our stocks in the hands of dealers are also quite low. (April 6).—Chas. D. Gaines.

Wisconsin

There does not appear to be much evidence of any marked increase in the 1937 potato acreage as a result of the comparatively good prices obtained from the 1936 crop. Many growers report intentions to plant about the same as in 1936.

Only a few scattered cars of the 1936 certified crop remain. These are mostly of the Irish Cobbler and Rural New Yorker varieties.

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Communicate with William H. Martin, New Jersey Agricultural Experiment Station, New Brunswick, N. J.

Until today, the 13th of April, the weather has been cold and the season backward. It is doubtful if any of the early crop will be planted before the 1st of May.

The Wisconsin Potato Growers' Association will hold a regional meeting at Rice Lake on the 21st of April. The 1937 Convention and State Potato Show will be held at Rice Lake in October.

Planting plans are now nearly complete for several variety and seed potato demonstration projects to be conducted by the College of Agriculture. These demonstration plots will be conducted on a field scale including the newer varieties recently introduced in comparison with the older standard varieties. Four of the County Asylum farms in Wisconsin located in the commercial potato-growing area are cooperating in these potato improvement projects. (April 13).—J. G. Milward.

Canada

A very great demand for certified seed potatoes developed this season and approximately one and a half million bushels were shipped from the 1936 crop before the first of April. The seed crop will probably be completely cleaned up this season at good prices. An increase in the seed potato acreage is expected in 1937, but will probably not exceed five per cent as many of the principal seed growers have left themselves rather short of their usual requirements.

The two full cargoes of certified Green Mountains which were exported from New Brunswick to Argentina last fall arrived at their destination in good condition. Upon their arrival they were planted, and a report received here in February indicated an exceptionally good growth of tops and every indication of a good crop. The Argentine crop, from their own locally-grown potatoes, was again disappointingly low, and fairly large quantities of seed potatoes will probably have to be imported again next season.

The Katahdin variety produced a very good quality crop in Western Ontario in 1936, under exceptionally trying seasonal conditions, and a substantial increase in the acreage planted to that variety is indicated for 1937. In that district it maintained its shape exceedingly well compared with the Rural New Yorker and the Green Mountain varieties which were greatly elongated because of the exceptionally hot dry weather in July, followed by a long open wet fall. (April 5).—John Tucker.

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TABLE 1.—*Rainfall and soil temperature during the growth of the 1936 potato crop*

Age from Planting (Days)	Soil Temperature* (Degrees F.)	Rainfall (Inches)
0 to 7	48	2.0
7 to 14	52	0.7
14 to 21	53	0.6
21 to 28	58	0.8
28 to 35	56	3.0
35 to 42	59	1.2
42 to 49	61	0.6
49 to 56	63	0.0
56 to 63	70	0.2
63 to 70	72	0.0
70 to 77	73	0.3
77 to 84	74	0.0
84 to 91	79	1.8
		Total 11.2

†Data taken from 3-6 to 6/4.
*Temperature to a depth of six inches.

analyzed by rapid chemical methods for total soluble nitrogen, total soluble phosphorus, potash, magnesia, and lime by methods also previously outlined (2, 3, 4). By the first of the above methods of analysis the total amount of materials taken into the plant to a given date was found, and by the sap analysis some indication of the current absorption of the plant as influenced by availability of the nutrients in the soil was determined.

The fields from which the plants were taken were considered to be normal average potato-producing areas and all of them were located within a radius of five miles. Their organic matter content varied from 1.79 per cent to 2.70 per cent and their water holding capacity from 24.4 per cent to 32.4 per cent. At the time the first samples were taken, forty-two days after planting, the soils were analyzed by the Soils Department by methods already reported (5) and gave the following tests: pH, 5.0-6.0; NH_3, poor to fair; P, very good; K_2O, good; and MgO, poor to good.

The mean weekly soil temperatures and rainfall for the growing season are given in table 1 and can be used as a partial basis of comparison with the meteorological data from other sections, in adjusting these results to those obtained in other areas of the country. From the data it is observed that a lack of adequate rainfall during the critical growing period, from the fiftieth to the eightieth day, caused poor

growth, resulted in low yield, and probably altered the normal mineral absorption of the crop.

Results and Discussion

The plants emerged thirty to forty days after planting, and the first samples were taken on April 16 at the beginning of the seventh week, and weekly thereafter until June 6th. Fig. 1 shows, graphically, the development of the plant in terms of its weight in pounds to the acre, and the tubers in terms of barrels to the acre. Forty-two days after the planting, the weight of the entire plant, exclusive of the seed, was less than 300 pounds to each acre. However, between the fortieth and sixtieth day the weight per acre of the plant increased from 300 pounds to 3600 pounds and continued to increase at the same rate until the eightieth day, after which the plant rapidly lost about 200 pounds to the acre each day until harvesting ended the record.

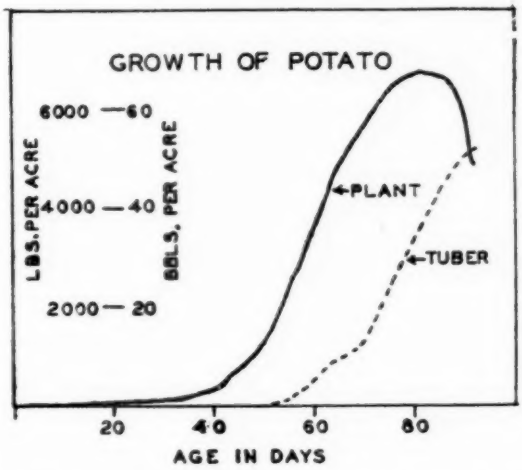

Fig. 1—The seasonal growth of the potato plant in pounds to the acre and the tubers in barrels for each acre.

On the fifth of May, two months after planting, the plants had produced only five barrels of tubers to the acre, and during the next ten days the potatoes developed at the rate of two barrels a day and continued to develop at this rate until the ninetieth day. At this time the price made it expedient to harvest the crop and the experiment consequently was discontinued.

In figures 2 to 6 the amounts of N, P, K_2O, MgO, and CaO found in the plant at weekly intervals are shown graphically. The small unshaded blocks on the graphs are estimates of the nutrient intake during the first six weeks after planting. At the beginning of the seventh week, on the 16th of April, the darkened areas represent the pounds of the various nutrients for each acre found, calculated on the basis

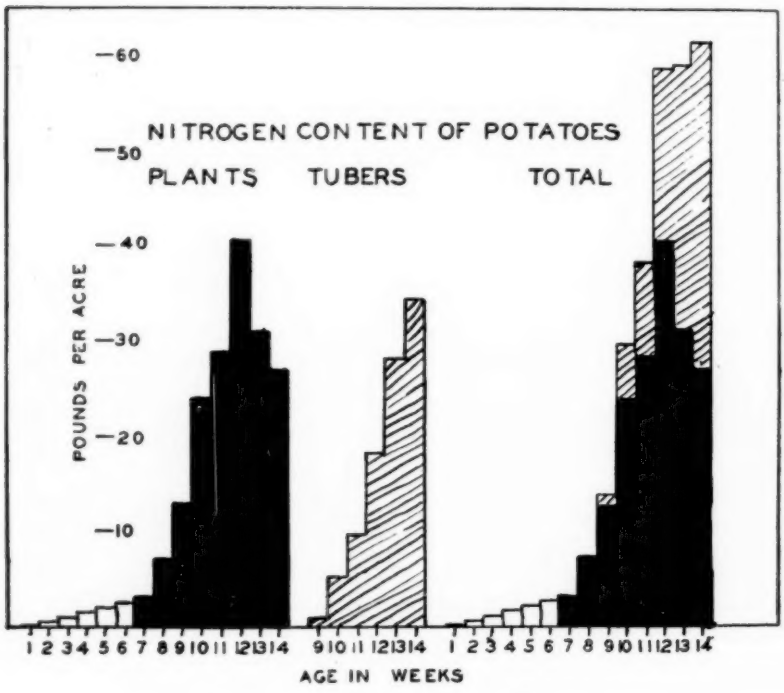

FIG. 2—NITROGEN CONTENT OF THE POTATO PLANTS AND TUBERS AT WEEKLY INTERVALS THROUGHOUT THE GROWING SEASON.

of an 80 per cent stand. At the ninth week tuber formation occurred and the cross hatched areas represent the amount of materials found in them at successive weekly intervals.

The fertilizer practices followed on all three farms resulted in the application of approximately 123 pounds of nitrogen, 53 pounds of phosphorus, 106 pounds of potash, 50 pounds of magnesia, and an undetermined amount of lime, to an acre. The average maximum total nutrient requirement of an acre of potatoes from planting time to harvest was 63 pounds of nitrogen or 51 per cent of the application, 9.4 pounds of phosphorus or 18 per cent of the application, 120 pounds

of potash or 119 per cent of the application, 12.3 pounds of magnesia or 25 per cent of the application, and 30 pounds of lime. Almost the entire amount of lime, 70 per cent of the magnesia, over 40 per cent of the nitrogen and potash, and less than 25 per cent of the phosphorus that was absorbed by the plant during its growth was returned to the soil in the foliage.

During the first fifty days after planting less than seven pounds of nitrogen were utilized by the plant. However, in the next ten days over a pound a day was absorbed and during the following twenty days it had an average intake of two pounds a day to the acre. After the plant itself stopped growing, on about the eightieth day, there was a gradual loss from the foliage which, however, was entirely compensated for by a similar gain in the tubers.

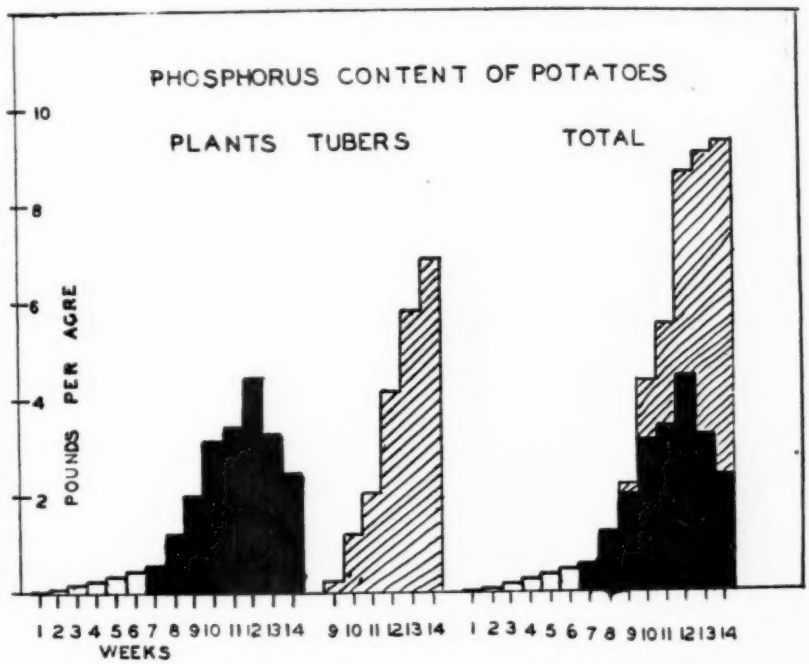

FIG. 3.—PHOSPHORUS CONTENT OF THE POTATO PLANTS AND TUBERS AT WEEKLY INTERVALS THROUGHOUT THE GROWING SEASON.

Phosphorus was absorbed at a rate very similar to that of nitrogen but in approximately one-sixth the quantity. However, the tubers utilized a much larger portion of the total phosphorus application than of the total nitrogen applied.

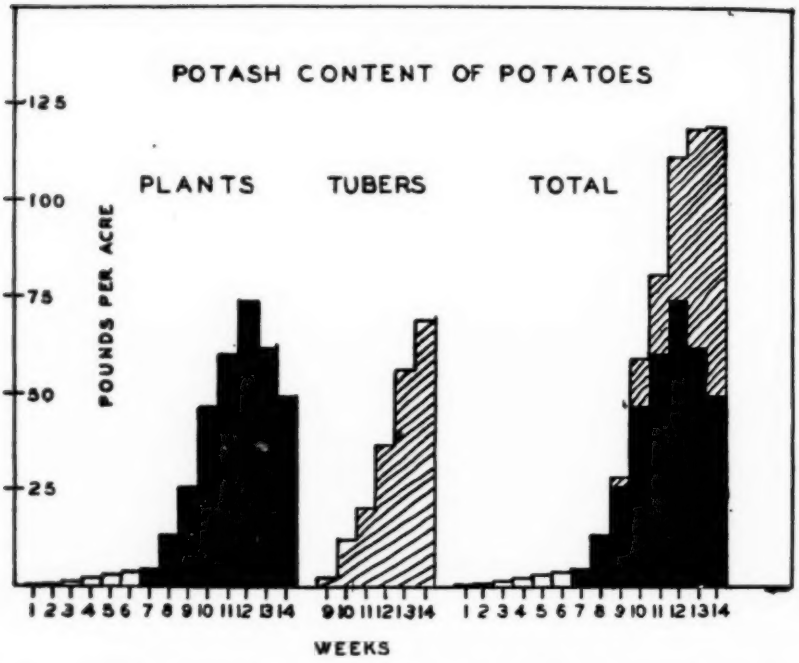

FIG. 4.—POTASH CONTENT OF POTATO PLANTS AND TUBERS AT WEEKLY INTERVALS THROUGHOUT THE GROWING SEASON.

Approximately twice as much potash, fourteen pounds to the acre, as nitrogen was absorbed by the plant during the first fifty days of growth and for the next thirty days potash continued to be taken into the plant at twice the nitrogen rate, or two pounds a day from the fiftieth to the sixtieth day, and four pounds each day from the sixtieth to the eightieth day. As the season ended on the ninety-second day the tubers contained 59 per cent of the total potash as compared with 43 per cent of the total nitrogen absorbed. After the eightieth day the plants lost nearly one-third of their nitrogen and potash and 47 per cent of their phosphorus, but these materials probably had been re-utilized by the rapidly developing crop of tubers. According to Wilforth and others (6), who studied the nutrient requirements of several plants including the potato at various stages of growth, there is no return movement of nutrients to the soil from a growing potato crop, but a continuous intake of nitrogen, phosphorus and potassium until harvest.

The magnesia content of the plant analyzed fifty days from planting was less than that of any of the other nutrients studied and had

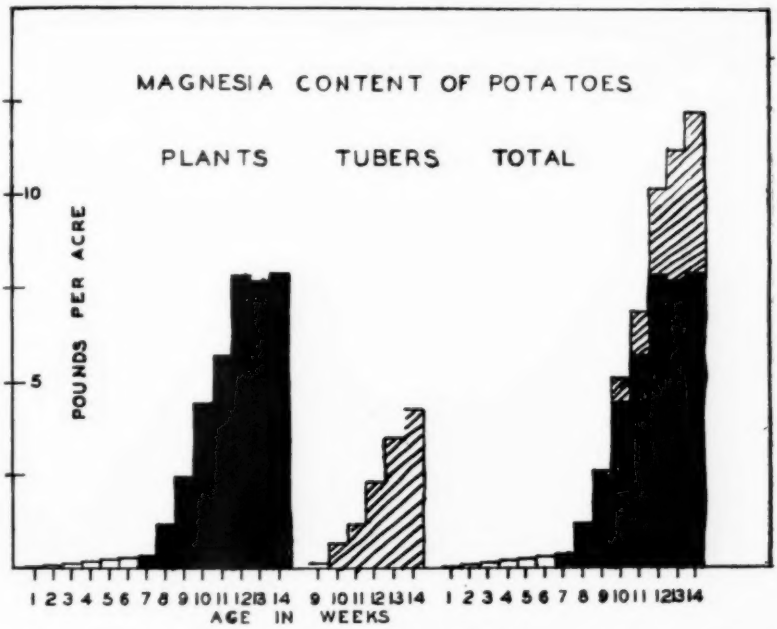
MAGNESIA CONTENT OF POTATOES
PLANTS
TUBERS
TOTAL
10
5
POUNDS PER ACRE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 9 10 11 12 13 14 1 2 3 4 5 6 7 8 9 10 11 12 13 14
AGE IN WEEKS

FIG. 5.—MAGNESIA CONTENT OF POTATO PLANTS AND TUBERS AT WEEKLY INTERVALS THROUGHOUT THE GROWING SEASON.

reached an average of only one pound to the acre. From the fiftieth to the sixtieth day 2.5 pounds were utilized and in the next ten days three additional pounds were required. The period of maximum requirement occurred between the seventieth and eightieth day when approximately 4.0 pounds were absorbed. There was little change in the magnesium content of the plant itself after this date, but tuber growth required approximately 1.75 additional pounds to give a total maximum seasonal requirement of 12.25 pounds to each acre.

Calcium is not generally considered in fertilizer formulation for potatoes and so is of interest in this study chiefly because only seven per cent of the total amount absorbed by the crop is found in the tubers. About one-fourth as much lime as potash is utilized by a potato crop. However, lime in the soil is of indirect value in altering the availability of other nutrients and preventing the toxic effects of others. At maturity the lime content of the plant had reached its peak and in this respect differed from any of the other nutrients. The fact that calcium was not lost from the plant and was found in such small amounts in the tuber would help substantiate the theory that some of the other nutrients migrate to the tubers at maturity to supply a pressing need.

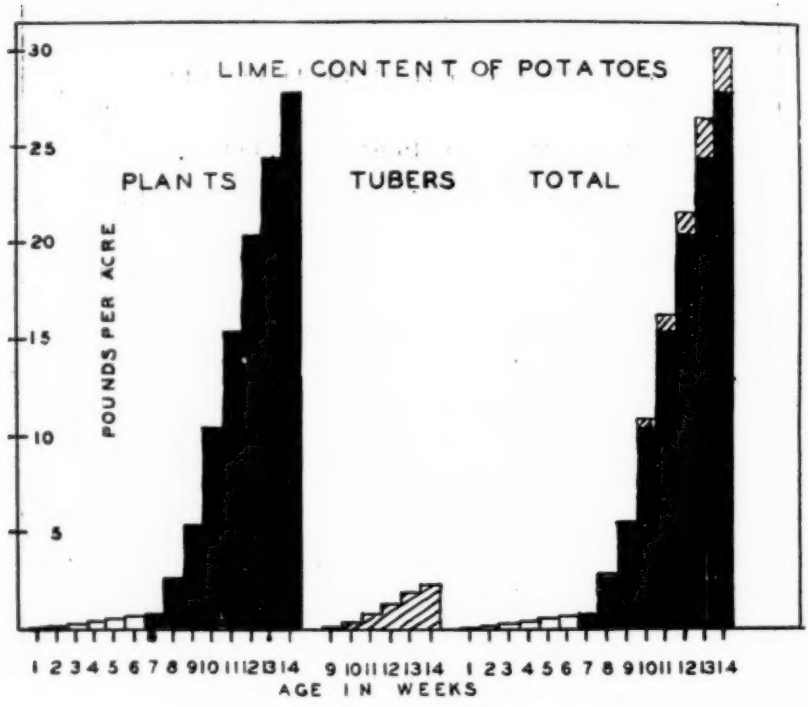
LIME CONTENT OF POTATOES
PLANTS
TUBERS
TOTAL
POUNDS PER ACRE
30
25
20
15
10
5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 9 10 11 12 13 14 1 2 3 4 5 6 7 8 9 10 11 12 13 14
AGE IN WEEKS

FIG. 6.—LIME CONTENT OF POTATO PLANTS AND TUBERS AT WEEKLY INTERVALS THROUGHOUT THE GROWING SEASON.

The period or periods of growth during which the plant has the maximum requirement for each of the nutrients has been discussed above. The aim of every grower is to keep the nutrient supply of the soil adequate at all times to meet the needs of the crop during these critical periods. However, long durations of rainy weather combined with scanty fertilizer applications, may jeopardize optimum yields and cause producers great concern unless they can be definitely reassured that there are sufficient nutrients available to facilitate normal growth. From the above data, by complete chemical analysis, one may be able to judge partially the adequacy or inadequacy of the nutrient supplying power of his soil by estimating the intake during a definite period. However, the method is slow and complex and would involve analyzing separate groups of plants at the beginning and end of a definite period to show any change caused by absorption; as a single series of analyses giving the total absorption to the sampling date and representing the total nutrient supplying capacity of the soil would probably not show any conclusive differences

between areas that had only an immediate soil nutrient deficiency and those that were normal.

To check accurately on the nutrient supply of a growing crop or to diagnose the cause of some possible nutrient deficiency, a reliable and easily manipulated method of analysis, based on the current rate of absorption and including only recently absorbed and unmetabolized plant foods, is needed. In the following section of this report a method of this nature with examples of its practical application taken from the fields studied above, and a seasonal index for practical use with the potato crop under conditions similar to those occurring in Virginia this season will be discussed. It is hoped that from its use by experiment station workers, county agents, fertilizer manufacturers, and others, information may be accumulated that is both pertinent and applicable to large nearby potato growing areas.

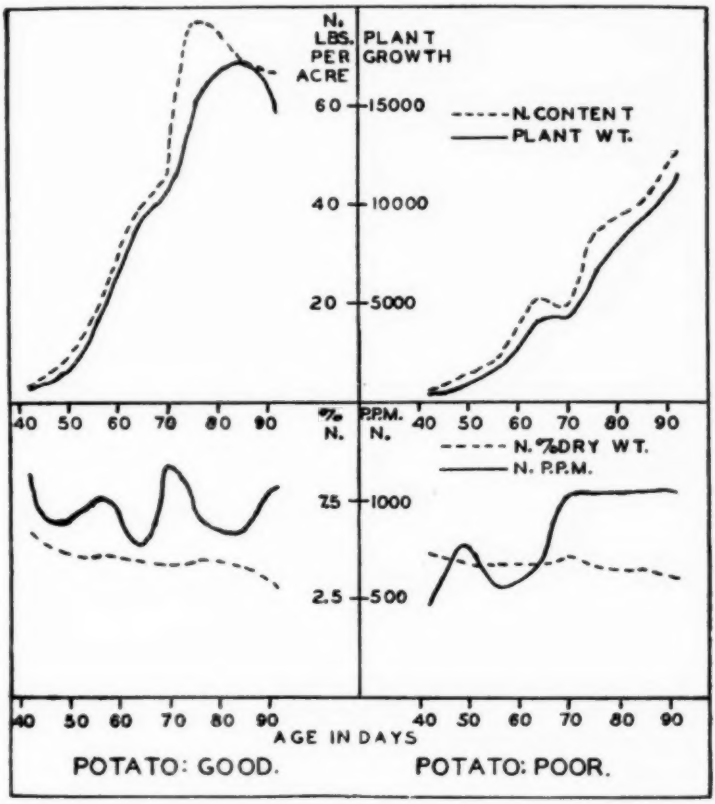

FIG. 7.—A COMPARISON OF VARIOUS METHODS OF DETERMINING THE INFLUENCE OF THE NITROGEN CONTENT OF POTATOES ON PLANT GROWTH.

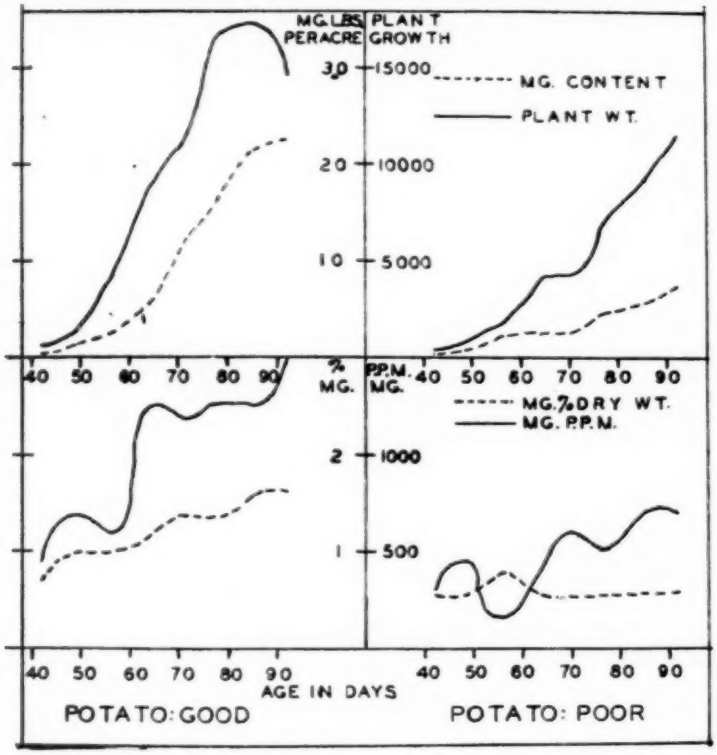

FIG. 8.—A COMPARISON OF VARIOUS METHODS OF DETERMINING THE INFLUENCE OF THE MAGNESIUM CONTENT OF POTATOES ON PLANT GROWTH.

The method is short; a complete series of reliable determinations for nitrogen, phosphorus, potassium, magnesium, and calcium can be completed on several samples of plant material in less than one hour's time. The results obtained measure quite accurately the plant nutrients that are being currently absorbed. The method, involving the grinding of a small portion of the main stem material from a fair sample of plants in a mortar with weak acetic acid and a determination of the filtered extract for the various nutrients, has been fully explained elsewhere (2), (3), (4).

In figures 7 and 8 the differences observed in the soluble nitrogen and magnesia content in the same plants from two of the fields from which the total nutrient level study was made are shown, in terms of the total amount absorbed by an acre, the per cent composition based on the dry weight of the plants and in parts per million in the extracted sap of a portion of the main stems. The graphs on the left, in each case, were made from the data collected from that con-

sidered to be a normal or good potato field and those on the right from that, which at the beginning of the season, at least was undoubtedly destined to be a poor yielding area. The final difference in yield between the two fields, however, was only eight barrels for each acre because of a correction in the nitrogen and magnesia nutrient supply of the poor area about midseason.

In figure 7 the upper graphs show the total plant growth and the total nitrogen absorption. The fact that there was a large difference between the fertility of the two fields is readily noted in the curves of plant growth and total nitrogen absorption. The lower graphs show the differences in the nitrogen content in terms of the per cent of the dry weight and in parts per million of the extracted sap of the main stems. Although there was a higher level of nitrogen when measured in terms of per cent in the good plants throughout the season the differences between the good and the poor plants were not so readily noticed as the differences in the soluble nitrogen content of the stems. On the forty-second day after planting the good plant had 1175 parts per million of soluble nitrogen in the stem as contrasted with 475 parts per million in the stems of the poor plants. During the next twenty days there were fluctuations in both poor and good plants caused by moisture and temperature conditions, but the soluble nitrogen content of the good plants averaged 300-400 parts per million higher than those of the poor ones. On the fifth of May, the sixtieth day from planting, additional nitrogen was added to the poor fields as a complete top dresser with the result that the plant's soluble nitrogen level rose about 400 parts per million in a week, and the continued dry weather throughout the balance of the season kept it at this higher level and resulted in a fairly good yield. The graphical representation of the nitrogen in parts per million in the potato plants on the two fields presented pictures so different in outline that there was no doubt that the addition of nitrogen was needed on the poor area and that the additional fertilizer was very beneficial to its potato crop.

In figure 8 the magnesia content of the same two areas is shown. On the good area a large application of dolomitic lime broadcast during the previous season kept the magnesia content of the plants as represented by the solid line in the graph on the lower left at a very high level. In the graph at the lower right, where the magnesia content is shown to drop to 150 parts per million in the plant on the fifty-sixth day from planting, magnesium deficiency symptoms, as commonly described, had begun to appear. On the sixtieth day ad-

ditional magnesium was added in the top dressing mixture and resulted in checking the malady in a week's time, whereas the magnesium content as shown in parts per million increased in approximately the

TABLE 2.—*Optimum weekly nutrient level of potato plants under Virginia conditions* (1936)

Age of Plant (Days)	Weight per Plant (Grams)	Sol. N.	Sol. P.	K_2O	MgO	CaO
42	26	1228	216	3500	350	800
49	60	988	148	5125	650	1100
56	160	1025	215	3750	675	1000
63	340	891	150	3125	1075	1100
70	470	1295	167	8250	1050	1100
77	630	1104	140	6350	950	1250
84	743	927	90	6000	1075	1800
92	673	1204	84	5900	1225	1900
Average for season		1085	152	5250	882	1315

(Expressed as p.p.m. in the expressed sap of the main stem.)

same proportion as that of the soluble nitrogen level, shown in figure 7.

The tests for phosphorus, potash, and lime were also made on the plants from these two fields but did not show any marked differences; so in a final report of the diagnosis the lack of nitrogen and magnesium only were considered to be responsible for the poor growth observed. Soil tests made at the same weekly periods were not reliable and varied considerably because of the fertilizer application. It was impossible to draw samples that were the same relative distances from the fertilizer application at all periods, and so the proximity of the fertilizer to the drawn samples affected the nutrient content of the sample to a large extent, because of the fact that the fertilizer had a higher nutrient concentration than the surrounding soil area.

In table 2, from the date of average emergence to harvest 1936, are listed the average weekly amounts of each nutrient in parts per million found in the expressed sap of the stems of plants from two normal potato fields. Under similar growing conditions, plants that do not contain at least 75 per cent of the amounts shown in these tests, at a comparative period in the life of the crop, should be considered deficient in the nutrient in question. This nutrient level outline for the potato crop should be modified to conform to meteorological conditions and the fertilizer practices conducted in the area in which the comparisons are to be made.

Conclusions

1. The potato crop is a gross feeder and has a large total nitrogen, phosphorus, potassium, magnesium and calcium requirement.

2. From its fiftieth to its eightieth day after planting it has its maximum nutrient requirement. In 1936 during this thirty-day maximum absorption period, an acre of potatoes absorbed nitrogen at the rate of 1.66 pounds daily, phosphorus at the rate of 0.3 pounds, potash at the rate of 3.33 pounds, and magnesia at the rate of 0.3 pounds for each day.

3. To ascertain accurately whether or not the nutrient level of the soil is adequate to meet the mineral requirements of the plant at any time during its growth, rapid chemical plant tests should be resorted to, because they are shorter and give a more definite indication of the nutrient intake than complete analytical methods, and are more reliable in diagnosing nutrient deficiencies than soil tests made after the fertilizer materials have been applied.

4. Tests made on the stem of potato plants at critical periods, or in diagnosing deficiency symptoms under conditions similar to those of this experiment should, under optimum growing conditions, indicate a minimum soluble nitrogen content of 700-800 parts per million, a minimum soluble phosphorus content of 150 at the beginning and 60 parts per million at the close of the season, a minimum potash content of 2200 at the beginning and 4500 parts per million at the end of the season, a minimum magnesia content of 275 at the beginning and 800 parts per million at the end of the season, and a minimum lime content of 600 at the beginning and 1400 parts per million at the end of the season.

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CONTROL OF A WILT DISEASE OF POTATO BY FORMALDEHYDE DUST

C. F. TAYLOR AND F. M BLODGETT

Cornell University, Ithaca, N. Y.

During the past few seasons a wilt disease of potatoes has assumed alarming proportions in certain fields in western New York. This disease has many of the symptoms described by Goss (1924) for the wilt disease attributed to *Fusarium eumarti*, Carpenter. In its early stages, on the Rural varieties, a bronzing of the leaflets of a leaf a little below the apex of the stem appears. This is followed by a yellowing and necrosis of the smaller leaflets. These symptoms gradually spread down the plant, and are often more severe on one side. Brown necrotic areas develop in the pith of the stem, more abundantly at the nodes, and these areas are usually larger in size and darker in color than the discolored areas associated with the yellow dwarf disease. Mature tubers show a dark brown discoloration of the vascular system, and frequently a rather wide zone surrounding it becomes discolored or water-soaked in appearance. Secondary soft rots may also develop in the tuber.

This disease, locally called "Z" disease, has occurred a few times in field experiments conducted for the control of potato scab. In these cases, data have been recorded on the amounts of "Z" disease in the plots during the summer and in the harvested crop. Since our observations for a period of three years are now available, they will be presented in this paper.

Since none of these experiments was directed primarily toward "Z" disease control, no attempt was made to obtain infected tubers for planting. The tubers used in these tests were from the required number of bushels taken from the storage bins and apportioned in equal amounts to the different treatments in the field. When cutting the seed tubers, all badly discolored or rotten tubers were discarded. An attempt was made to obtain a random selection of seed tubers in all cases.

The accuracy of the tuber counts in these experiments was increased considerably by cutting a thin slice from the stem end of the tuber.

One experiment in 1934 showed the following amounts of "Z" disease: hot formalin 16.0 per cent; hot mercuric chloride 19.8 per cent; and the untreated checks, 15.5 per cent; whereas the plots treated

with 8 per cent formaldehyde dust yielded 1.5 per cent. This reduction was barely significant at the level of odds 20:1.

The 1935 series of experiments had but one experiment in which "Z" disease was present in appreciable amounts. In this experiment the plant counts on the 20th of September showed that the "Z" disease in the check plots averaged more than twice that in the dust-treated plots. Possibly because these plants, as well as doubtful ones, were pulled to check the diagnosis and when the field was rogued, the tuber counts showed small differences.

Two fields in the 1936 series of experiments developed a considerable amount of this disease. Plant counts were made late in the growing season. Before making these counts, the symptom expression was confirmed by examining the tubers from plants in the fields surrounding the experiments. Using the symptom expression of these plants as a basis, counts were made in the plots without the necessity of pulling the plants to confirm the diagnosis, thus adding to the value of the subsequent tuber counts on the harvested crop.

TABLE 1.—*Field control of "Z" wilt disease of potatoes*

	Hot Formaldehyde	Formaldehyde Dust		Check	Diff. Prob. Sign. 20:1
		6 Per Cent Immediate Planting	8 Per Cent Immediate Planting		
1934					
Matthews *t*	16.0		1.5	15.5	13.5
1935					
Matthews *p** ...		1.34	2.62	5.63	2.6
Matthews *t*		3.50	0	2.25	not
1936					
Van Voorh. *p* ..	7.7		1.1	3.4	2.5
Van Voorh. *t* ..	12.9		1.1	8.0	3.3
Dunn *p*	7.4	4.9	4.3	12.9	3.9
Dunn *t*	3.0	2.7	2.7	13.3	4.4

*t*Tuber counts on harvested crop; per cent tubers infected.
*p*Plant counts late in growing season; per cent plants infected.
*Many plants pulled to check diagnosis; tuber count seriously affected.

The "Z" disease averages of these four experiments are presented in table 1 where the only consistent trend is the decrease in "Z" disease following the treatment with formaldehyde dust. Considerable variation exists in the results with hot formalin but unfortunately no data are available which explain the discrepancies in this treatment.

The 8 per cent formaldehyde dust used throughout these tests was

prepared in the proportion of one pound of commercial formalin to four pounds of uncalcined Celite and mixed in a barrel churn. The prepared dust was packaged in paraffined paper bags until used. Three ounces of dust were applied to each bushel of seed pieces.

Our experience in New York indicates that the treatment should be applied immediately before planting. This is true especially on hot sunny days when a delay of one or two hours between treatment and planting may lead to serious decreases in stand and yield. Such decreases have not been observed when planting has been delayed for less than one hour, or for two or three hours on cool cloudy days.

This danger of injury presents serious problems in the commercial use of this treatment. A yield summary for the hot formalin treatments, dust treatments, and untreated checks in all fields in which the 8

TABLE 2.—*Yield summary from experiments in which the formaldehyde dust indicated has been tested*

Increase in Bushels per Acre

	Hot Formaldehyde over	Check over
8 Per cent formaldehyde dust immediate planting	$-11.61 \pm 13.5^{**}$ (54*)	-4.67 ± 8.2 (71)
8 Per Cent formaldehyde dust delayed planting	48.75 ± 9.1 (32)	36.7 ± 13.0 (36)
Hot formaldehyde		-4.89 ± 7.4 (86)

*Number of comparisons.
**Standard Error.

per cent dust has been used, table 2, shows that a decrease of 36.7 bushels to the acre was obtained as a result of delay in planting after treatment. No planting in this comparison was delayed for more than four or five hours and, in some cases, only slightly more than one hour. In those comparisons where planting followed within one hour after treatment, or on cool days, the yield was slightly, but not significantly, higher than that from the untreated plots.

A comparison of the total number of scabbed tubers, table 3, shows that the 8 per cent dust is not appreciably different from the hot formalin treatment in this respect and that both treatments are slightly better than the untreated checks.

TABLE 3.—*Summary of scab results from experiments in which formaldehyde dust was used*

	Increase in Per Cent of Total Tubers Scabbed	
	Hot Formaldehyde over	Check over
8 Per cent formaldehyde dust, immediate planting	54* / —0.05 + 1.27** / —	72 / 4.7 + 2.24 / —
8 Per cent formaldehyde dust delayed planting	32 / 2.28 + 1.25 / —	36 / 3.81 + 1.81 / —
Hot formaldehyde		86 / 5.34 + 1.86 / —

*Number of comparisons.
**Standard Error.

Goss, R. W. 1924. Potato wilt and stem-end rot caused by *Fusarium eumartii*. Nebr. Agr. Exp. Sta. Res. Bul. 27:1-83.

The results from these experiments indicate that treatment with formaldehyde dust reduces the injury from this wilt disease of potatoes sufficiently to be of great importance in seed production, but that serious yield decreases may result if extreme precautions are not observed in using the treatment. The partial success of the treatment raises the interesting question: How is the control of a wilt disease brought about by seed treatment?

VARIETAL DIFFERENCES IN INSECT POPULATIONS AND INJURIES TO POTATOES

FRANK B. MAUGHAN

Cornell University, Ithaca, N. Y.

For several years a number of potato varieties have been tested in many localities throughout New York State. These tests were conducted to determine the regional adaptation of available potato varieties to various soil types and climatic factors as reflected in final yields. An opportunity has been afforded in the past two years to obtain information on potato varietal susceptibility to insect attack. Quantitative studies of insect populations occurring on several

potato varieties were started in 1935 in Orange County, New York, and some of the results are presented in this paper.

Both early and late-maturing varieties were included in the test blocks which were located within the boundaries of a commercial planting of potatoes. The crop row method was followed in arranging the plats. The varieties, each of which was replicated four times, were planted in rows 25 feet in length and 32 inches apart. None of the plants received any spray or dust applications. During the season of 1935 flea beetle and leafhopper populations were determined by sweeping five potato plants of each variety in each replication with an insect net. The abundance of flea beetle feeding punctures and leafhopper nymphs on each variety was determined by counting one hundred leaflets selected at random from five plants of each variety in each replication.

The varieties tested and the results obtained in 1935 are shown in table 1. All varieties had a comparatively large number of flea beetle punctures on each leaflet with considerable variation among the varieties. Chippewa, Warba, Katahdin and Spaulding Rose had the largest numbers of flea beetle punctures on each leaflet, whereas Up-to-date, White Rural and Late Rose had the fewest punctures to the leaflet. There were marked differences in both the numbers of beetles on each plant and the ratio of these numbers to the amount of feeding. Up-to-date, a small-leaved, late variety, and Katahdin, a large-leaved, mid-season variety had the highest ratios of insects compared with the amount of feeding. Russet Rurals, Cobblers and Warba although relatively high in both numbers of beetles and holes to the leaflet were low in terms of amount of feeding for each beetle. There are so many factors involved in flea beetle feeding that it would be unwise to base any final conclusions on the data from a single year. The differences obtained do, however, raise suggestive questions as to possible varietal differences ordinarily considered unimportant. The first instar of leafhopper nymphs was found on all varieties which indicated that the adults oviposited on all potato varieties tested. The plants showed larger variations in the numbers of adults on each plant, than in the numbers of nymphs, (table 1). It is interesting to note that the varieties having fewer flea beetle punctures to the leaflet and fewer flea beetles and leafhoppers to the plant, were in general, the late-maturing types. Hopper-burned leaflets were more prevalent on the early-maturing varieties, which were practically 100 per cent affected by the 25th of July, whereas the late-maturing varieties such as Up-to-date, White Rural and Late Rose showed only a small percentage of the leaves affected by September 1.

During the season of 1936 a more comprehensive study of insects infesting potato varieties was conducted. The arrangement of plats was similar to that employed the previous season, but the procedure for determining the insect populations was changed. A large insect net was placed over individual potato plants which were then shaken until the insects were in the bottom of the net. The insects were placed in vials containing 85 per cent alcohol and these were later counted in the laboratory. The varieties tested and the relative numbers of insects on each plant are shown in table 2. In this table, the varieties are classified according to the seasonal average numbers of insects to the plant as follows: Group 1, includes those varieties having a seasonal average of less than 1000 total insects to the plant; Group 2, those varieties with a seasonal average between 1000 and 1500 total insects per plant; and Group 3, those varieties with a seasonal average of more than 1500 insects on each plant.

The data clearly indicate that all varieties tested were subject to attack by the major potato insect pests. As in the previous season there was considerable variation in insect populations among the varieties. Flea beetles were abundant on all varieties and considerabe injury resulted from the feeding activities of this insect. They varied from 44 to the plant on S45075 to 118 on each plant of the Mason Rural and Katahdin varieties. The late-maturing varieties showed fewer flea beetles punctures to the plant. Leafhopper nymphs and adults were found on all varieties, whereas Golden, Viking and S45075 showed fewer numbers of nymphs on each plant than did the other varieties. Adult leafhoppers varied from 64 on each plant on S45075 to 153 on the Houma variety. In general, the late-maturing varieties had fewer leafhoppers on each plant than did the earlier varieties.

There were large differences between the average numbers of aphids on plant varieties, with a maximum of 3323 on each plant of the Chippewa variety, and a minimum of 428 to the plant on Aaron Banner, (table 2). Why the varieties in group 1, (table 2) showed a lighter infestation of aphids is not clear. The heavy infestation of aphids on varieties such as Chippewa, Cobblers and Katahdin may have been influenced by their advanced stage of growth and the larger leaflets at the time when the aphids were migrating into the potato fields. Certainly the varieties in group 1 had significantly fewer aphids to the plant than did plants of other varieties.

The appearance of hopper-burn on the foliage of the potato varieties was similar to the previous season. The foliage of the early-maturing types was severely affected during the latter part of July and the plants were ready for harvest on the 10th of August. The late-ma-

turing varieties showed little hopper-burned foliage and did not mature until the 1st of September, when injury appeared on approximately 50 per cent of the leaves. Apparently the appearance of hopper-burn on potato foliage is associated with the stage of growth of the plant.

TABLE 1.—*Insect populations on untreated plants of potato varieties, Orange County, New York,* 1935

Variety	Flea Beetle Holes per Leaflet	Ratio of Beetles to Holes	Flea Beetles per Plant	Leafhoppers	
				Nymphs Per Leaflet	Adults Per Plant
Up-to-Date ...	52	2.6	24	3	44
White Rural ..	64	1.1	58	4	77
Late Rose	73	1.4	51	4	63
Russet Rural .	77	.9	85	3	78
Cobbler	77	.65	118	4	79
Golden	102	1.67	61	4	69
Spaulding Rose	87	1,22	71	4	111
Green Mt.	84	1.01	83	6	93
Warba	107	.71	151	8	73
Katahdin	158	2.2	72	6	98
Chippewa	117	1.14	103	3	89

TABLE 2.—*Numbers of insects on each plant in potato varietal experiment, Orange County, New York,* 1936

Variety	Flea Beetles	Leafhoppers		Aphids	Tarnished Plant Bugs	
		Nymphs	Adults		Nymphs	Adults
		Group I				
Arran Banner	53	52	127	428	2	1
Golden	70	32	94	685	3	2
Vt. Viking ...	94	26	86	539	4	4
Green Mt. ...	81	52	84	671	8	.3
Averages	74	41	97	581	4+	2—
		Group II				
Houma	71	44	153	1061	3	.3
S45075	38	31	64	1213	4	2
Mason Rural .	118	40	69	1359	2	3
Warba	91	49	115	1265	5	3
Averages	79	41	100	1224	3.5	2+
		Group III				
Chippewa	101	64	64	3323	5	0
Cobbler	62	62	74	2468	4	2
Katahdin	118	31	88	1793	5	2
Averages	94	52	75	2528	4.5	1+

The results of two years' study on insect populations, occurring on potatoes, indicated that all varieties tested were infested with the major potato insect pests. However, it should be emphasized that in the case of the late-maturing types they were definitely infested with fewer insects on each plant and, in general, insect injury was less severe. The differences in insect populations on varieties of potatoes certainly warrant further study in projects dealing with the development of commercial types.

SECTIONAL NOTES

California

The climatic and growing conditions in Kern County have been ideal for the potato crop. The Edison District is now shipping potatoes and the 4,000 acres in this district are yielding 150 one-hundred-pound sacks to the acre of very good quality. Fourteen thousand acres of the total 19,000 acres planted in the balance of Kern County give evidence of producing a car or more to the acre. These 14,000 acres will easily ship 14,000 cars and possibly more.

The remaining 5,000 acres in this district are probably producing only one-half car to the acre or 2,500 cars, because of poor seed.

Total shipments from Kern County this season confirm the estimate I made last month that Kern County, during this season, if markets can be found, will ship from 18,500 to nearly 20,000 cars. At least 85 per cent of these will have to move by rail carrier.

The other districts in California are not important at the present time, as the vast quantities in Kern County far outweigh anything that can happen in any other area. (Apr. 30). H. G. Zuckerman.

A statement in the April issue concerning the condition of the California crop which read—"however, a disastrous frost which occurred during the month of April, when the potatoes were half formed, might change this picture entirely", should have read, "A disastrous frost during the month of April hitting the potatoes when they are half formed, would change this picture entirely."—(Editor).

Colorado

The early plantings of potatoes in Colorado were delayed about two weeks by the cold, wet weather, which means that there will prob-

ably not be any movement of new potatoes until after the 4th of July. Movement normally begins about the 25th of June.

All supplies of seed have been exhausted, and growers are still searching for potatoes to plant. Much inferior stock is going into the ground at the present time.

The planting of the late crop will not be completed until the latter part of June.

The precipitation during April was far below normal in the eastern part of the state, but the mountain sections are still well covered with snow, which practically assures an adequate supply of irrigation water for all sections during the summer.

Yields comparable to those of 1936 can hardly be anticipated, however, because of timely rains last year, and the fact that poor seed is being planted this year Considerable land not well suited to potato production, because of inadequate water, is also being planted. (May 10). C. H. METZGER.

IDAHO

It is rather early to make a very reliable guess as to the probabilities for potatoes in Idaho in 1937. The prevailing opinion is that our average planting will be about the same—possibly a little more than last year.

I anticipate that there will be approximately 115,000 acres. The factors involved are: a possible shortage of late water in some of our districts, particularly under the Boise project (that is, mostly in Canyon County); and prospects for an increase in the beet and bean acreage in the Twin Falls and Upper Snake River districts. Of course, the general trend is, that of greater interest in potato growing because of two years' above average prices received for potatoes.

The only evidence we have as to the trend is the fact that we received more samples of seed potatoes, than for the past several years, to test at our plots at Lewiston, Idaho. These consisted of 114 lots of Netted Gems; Bliss Triumphs, 39; Idaho Rurals, 13; Early Ohios, 5; Katahdins, 3; Cobblers, 6; Warbas, 1; and McClures 1; making a total of 182 lots.

The late spring has retarded growth to the extent that even the earliest planted potatoes in the state are just now showing above the ground. At the present time, we can make no statement regarding health conditions as influenced by last year's growing season, although the indications are that virus diseases were not disseminated last year so extensively as they have been some other seasons. (May 12). E. R. BENNETT.

INDIANA

The early planted potatoes are just through the ground and ready for the first cultivation. Although the weather has been cool and wet, with very little sunshine, the potatoes are growing nicely and we have some excellent stands. Some growers in northern Indiana will plant their late crop during the latter part of this month. White Rurals, Cobblers, and a few Katahdins will be the main varieties. A majority of the growers will plant their late crop next month. Some certified Cobbler seed is being offered here at $2.00 per hundredweight. (May 7). W. B. WARD.

LOUISIANA

Indications at present point to the fact that Louisiana may ship about 3,300 cars of potatoes this season.

The Terrebonne and Lafourche districts are now loading 50 to 60 cars a day in addition to scattered loadings bringing the total for the southern district to approximately 100 cars daily.

The Pointe Coupee district should load heavily during the week of May 17, and the Alexandria district should load heavily during the week of May 24.

The potato situation at this time seems to be about 60 per cent of last year's crop. The crop in the Terrebonne and Lafourche districts was severely injured by heavy rain and hail the 1st of May. Most of the growers are harvesting about 10 to 1 of seed planted, which is about half of normal. However, the upper districts, New Roads and Alexandria, may do somewhat better.

Harvesting began in a small way on April 15 and was well underway by the 5th of May. F. O. B. prices for U. S. No. 1's to May 6 ranged from $2.50 to $3.50. However, at this time the market is weaker.

There are seven potato washing machines, of different makes, operating at several points.

Some of the leading Louisiana growers will place in storage about 15,000 sacks of Louisiana certified seed potatoes (U. S. No. 1 small-1½ to 1⅞ inches in size). This seed has given excellent performance in south Florida and in Cuba. This year's seed crop will be ready to move from storage in September. (May 10). J. G. RICHARD.

MASSACHUSETTS

The planting of the Cobbler crop began the 5th of April and was largely completed during that month. Nearly all the Green Moun-

tain variety has been planted. Planting conditions have been fairly normal with expectations of approximately the same acreage of potatoes as last year. (May 12). RALPH W. DONALDSON.

MISSISSIPPI

Reports from the Southern part of Mississippi, which is our early potato-producing section, indicate that our spring Irish potato crop is progressing satisfactorily.

A much larger acreage than normally was planted and, although some unfavorable weather has been experienced, as a whole the crop is making excellent progress.

Growers are estimating that four or five hundred cars will be shipped from Marion county and seventy-five to eighty cars from Lawrence county. (May 12). T. M. PATTERSON.

NEBRASKA

The acreage of early potatoes planted in the North Platte Valley this year is considerably greater than the acreage planted last year. It is also greater than the area normally planted with early potatoes. Soil and moisture conditions are very favorable for the potatoes already planted. Some of the earliest plantings are emerging at this time. These may be in some danger of frost injury because of the cold, backward season. There is still some possibility of severe freezing weather in this section. The late crop will not be planted until the middle of June. Information available regarding late crop planting intentions, indicates that there will be some increase in the late crop acreage compared with the acreage planted last year. At present, it seems that the increase in the crop acreage will not be so great as the increase in the early crop acreage. The high price of seed stocks is undoubtedly limiting the expansion of the late crop acreage.

In the surrounding dry land territory there will be a great reduction in acreage because of the high price of seed stocks and the almost total lack of subsoil moisture. Potato growers in the dry land territory, in general, do not feel that they want to take a chance this year under these adverse conditions.

The supply of seed potatoes in the North Platte Valley will be adequate for planting needs here, although seed is selling at rather a high figure. (May 11). L. HARRIS.

NEBRASKA

At this time, very few potatoes are being planted in Western Nebraska. The early, commercial production is generally confined to the

area around Kearney in Central Nebraska, where potatoes are planted during the early part of April.

Plans for planting potatoes in Western Nebraska are still very indefinite with the dry land growers. Spring rains have been slight to moderate in most of the territory, and soil conditions are still far from desirable. The drought conditions of 1936 resulted in the loss of surface moisture in the soil to the depth of 10 to 20 feet, depending on the crop planted last season. The available moisture at the present time varies in depth from 12 to 24 inches, which is considerably less than is necessary for the proper spring growth of crops. Although this is sufficient to start the potatoes that will be planted, generally about the first of June, it is not enough to insure their growth. It is desirable to have at least from 3 to 5 feet of moisture in the ground at planting time. One of the most distressing features has been the recurrence of wind and dust storms. This condition tends to sap much of the moisture from the soil.

The actual acreage of potatoes to be planted is still doubtful, but indications are that there will be a slight increase on land that is irrigated, and probably 50 per cent or more reduction of dry land plantings. Since the greatest acreage planted is on dry land, this will mean a considerable reduction in the total plantings in Western Nebraska in 1937. (May 13). MARX KOEHNKE.

SOUTHERN STATES

The writer has just returned from a trip through the southern states, having left there on the 25th of April. At that time conditions through Southern Alabama, Louisiana and Mississippi, were quite favorable for the production of a good crop of potatoes. Conditions during the week previous to the 25th of April had been rather hot. Ample rainfall and temperature decrease about that time insured a crop of high quality.

The crop this season was quite backward compared with 1936, because of cold, rainy weather at planting time. In fact the very earliest plantings suffered materially and will probably yield less than one-half a crop. This was particularly true of the south end of Baldwin county, and in parts of La Fourche and Terrebonne Parishes, Louisiana.

During the week of April 19 one car of potatoes was shipped from each of the territories mentioned in Louisiana and Alabama. Growers and shippers did not expect the real harvest to take place until the end of the following week or ten days.

A great deal of non-certified seed potatoes had been shipped from the North this winter, because of the fact that the certified seed was

very short in North Dakota, Wyoming and Nebraska. Some of this stock was making a good crop, but generally speaking, it had a great deal of disease, or was otherwise unsatisfactory. The certified potatoes shipped from the Northern States was of high quality and was producing a very good crop, where conditions were favorable.

A great deal of certified seed from Maine found its way into these territories this season, probably because of the large crop produced there. In the average season, however, the majority of the shipments originate in the Northern States.

The Bliss Triumph is the principal variety that is being planted. However, more Irish Cobblers were to be found this season than usual, with a sprinkling of Katahdin and Warba. The southern growers are watching any new varieties very closely, and making an effort to produce varieties of their own that might be better adapted to their section of the country. The measuring stick by which new varieties are being judged is the Bliss Triumph. Any new varieties introduced must exceed the popularity and productivity of the Bliss Triumph. One promising new variety, the Houma, has been produced by the Horticultural Department of the Louisiana State University.

The principal diseases still causing high losses for the Southern growers are rhizoctonia and black leg. A great deal of work is being done to encourage growers to disinfect their seed, even though it is certified and apparently free from surface-borne diseases. Despite the efforts of the Northern certified seed potato producers, rhizoctonia will continue to be a problem as long as untreated seed is planted

Progress is being made in the elimination of virus diseases. In spite of seasons of extreme drought that have been experienced during the last three or four years, the amount of virus diseases, principally Spindle tuber, Mosaic and "Hay Wire", (which is generally considered as virus, although its exact nature is unknown), seen this season was less than in the past. (May 12). MARX KOEHNKE.

SOUTH CAROLINA

Prospects are that there will be a larger crop of potatoes in this state than last year, although heavy rains, high soil acidity (in some cases) and disease will result in lowered yields to the acre in Charleston county. Beaufort potatoes look very good, as a whole. The majority of cuts in yield were caused by a frost which occurred the first of April and by heavy rains since that time. Very little late blight has appeared to date, but scatterings of black leg and rhizoctonia have been observed.

Some growers will begin to dig potatoes by the 17th of May but most potatoes from this state should move around the 20th to the 27th. (May 7). J. W. JENKINS.

NEW JERSEY

The crop is coming up and, in general, the stand promises to be good. There are some reports of sprout injury from rhizoctonia but this is not believed to be extensive. Weather conditions are now excellent for the growth of the crop.

A conference of seed potato certification officials has been arranged for June 17 and 18 at Cranbury. Visitors will meet in New Brunswick at the Woodrow Wilson Hotel on the morning of June 17. Transportation will be arranged for those coming by rail. (May 17). W. H. MARTIN.

NORTH CAROLINA

The Irish potatoes in the earliest producing section of the state are beginning to bloom. We have had lots of rain this spring, and in low places the stand is not so good, but in general the crop looks very good for this season of the year. Unless unfavorable conditions develop, we should have a big crop of early potatoes. I believe the harvest season will begin about the first of June, with the peak of the season about the middle of June. (May 10). ROBERT SCHMIDT.

NORTH DAKOTA

Eastern North Dakota, lying in the Red River Valley, has had almost super-abundant rains this spring, and sufficient moisture is therefore available to begin the production of a very fine potato crop. At least 75 per cent of the commercial potato production of the state, including both common potatoes and certified seed stock, lie in this Valley.

The central part of our state has had a fair amount of rainfall, enabling our potato growers to make a fairly good start. The extreme western part of the state, where a certain quantity of certified Bliss Triumph seed potatoes are produced, has not had very much rain this spring or not very much moisture of any consequence for crop production from the winter snowfall. This area does, however, have enough moisture to sprout the potato crop which may be planted.

In the eastern part of the state, where most of our potatoes are

grown, present indications are that there will be no increase in acreage over average conditions. If any variation might exist as we see the situation today, it might be in the direction of a slightly lower acreage. This will, however, produce a larger volume than last year because we are anticipating better yields because of better moisture conditions.

In the central and western parts of the state the commercial potato acreage, both of common potatoes and certified seed stock, may be about thirty per cent below a five-year average, partially because of the fact that there is a shortage of good seed. In the extreme western part of the state some people are a bit discouraged because moisture conditions are still somewhat doubtful for the production of a fair crop.

The quality of our certified seed this year promises to be exceptionally good. By means of an intensive use of seed plots, by greenhouse testing, and by the testing of stock in several trial plots in the South, we have been able to eliminate certain lots of seed that may not prove desirable. This enables us to choose and accept for certification only the best lots and strains of seed. A very intensified seed improvement program is being conducted which we are certain will yield good results and place the certified seed industry on a very high plane.

Because of the heavy rains this spring, our planting season will be somewhat delayed. The peak of our planting operations will probably be reached about the 20th of May, and indications point to a very quick and vigorous growth. (May 7).—E. M. GILLIG.

NEW HAMPSHIRE

Potato growers are rather optimistic in their plans for 1937. Every one reports an increase varying from two to twenty per cent, with several farmers, who ordinarily do not raise potatoes, planning to plant some this season. The fairly favorable potato prices for the past few months, contrasted with the exceptionally low milk prices, have tended to stimulate interest in potato growing for this season.

Certified seed is moving, although very slowly. Table stock is much more active. Indications point toward a complete sell-out of the supply of certified seed in the county this year. Considerable interest seems to center around the newer varieties, particularly the Chippewa and Warba. (May 7).—DAN O'BRIEN.

OHIO

The planting of Cobblers throughout Ohio has been delayed from one to three weeks because of the cold, rainy weather. In keeping

with the trend of recent years, the acreage of Cobblers is probably slightly larger than last year. (May 7).—JOHN BUSHNELL.

OREGON

There will be another increase in the Klamath district. That area is a high mountain valley composed of portions of Siskiyou and Modoc counties, California, and Klamath county, Oregon. There has been a healthy yearly acreage increase through good and bad price cycles ever since the industry started there in 1925. Seven thousand cars were shipped from this area during the past year and we should ship 8,000 from the 1937 crop. Car lot shipments have grown as follows:

Year	*No. of Cars Shipped*
1925	135
1926	425
1927	920
1928	1,150
1929	1,375
1930	2,200
1931	2,500
1932	2,500
1933	3,300
1934	5,000
*1935	4,000
1936	7,000

*An early frost reduced the 1935 crop.

Over the remainder of the state there will be a slight acreage increase, but poor yields in Western Oregon have discouraged growers in the Willamette Valley where they shipped more potatoes twenty years ago than they do at present.

In 1934 and again in 1936 the Klamath potato crop was too large for its natural trade area—the northern and central California market. They, therefore, crowded into the Los Angeles market where they consistently sold for from 10 cents to 35 cents per hundred above the car lot prices paid for potatoes from any other area. This price superiority was initiated in 1934 by a successful radio advertising campaign, but in 1936 it was caused more by the dependable, superior quality of the Klamath.

All Klamath potatoes are Netted Gems, or Russet Burbanks as they are called elsewhere, and the soil and climate of Central Oregon

seem to produce a brighter, more blocky potato on the average than the Netted Gems grown elsewhere. At any rate, the Portland, San Francisco, and Los Angeles markets take them at substantial premiums. As a result, Klamath prices are usually higher to growers than prices in any other large potato growing area in the northern states, and even in the unlamented dark days when other growers were desperate, the Klamath folks were making money. Some potato growers in that area paid substantial income taxes throughout the depression period.

Perhaps one secret of the higher prices for Klamath's is the compulsory potato grading law in Oregon and the adjacent California counties. The law has been in effect in its present form for eight years,—and its beneficial results for the grower of quality potatoes cannot be questioned. Every sack sold in the state must be labeled as to grade and must carry either the dealer's brand or the grower's name and address.

No compromise is made with off-grades and only the U. S. grades recognized: U. S. Fancy, U. S. No. 1, U. S. No. 2, and culls. Many attacks have been made on the law by growers and dealers who find it difficult to meet the U. S. No. 1 grade. Usually these have been in the form of attempts to have the "commercial" grade legalized. Fortunately, growers have stood pat and market receipts have amply justified their stand.

Formerly, when "combination" and "commercial" grades were in existence, it worked out in the following manner for the grower. Suppose he had 1000 sacks of potatoes, which were 25 per cent No. 2 and he could get $1.00 per sack for his U. S. No. 1, and 60 cents per sack for his U. S. No. 2. He would, however, be afraid of the No. 1 grade and a dealer would offer him a contract on the base price of $1.00 with 5 cents off for every 5 per cent of U. S. No. 2, included and would instruct him to put in all of the number 2's. A little pencil figuring will show that if he gave away his number 2's and received only the price for the number 1's he would have fared as well. But perhaps more important, these combination grades *invariably* ruin the reputation of any district using them.

We believe one good provision of our compulsory grading act is that every retailer must display the grade with his potatoes, mark it on the small paper sacks, and must mention it in his ads. Previous to this, a grocer was afraid to advertise the price of U. S. No. 1, because a competitor would have a neighboring ad showing potatoes considerably cheaper. This has educated thousands of housewives who want

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good potatoes to ask for U. S. No. 1. Experience has also shown very clearly that a household which uses U. S. No. 1 potatoes uses many more of them. No. 2's and culls are perhaps as good in food value, but they are unattractive and more difficult to prepare. Households which we have checked have increased their yearly consumption 50 per cent since they changed from No. 2's to No. 1's. (May 8). E. R. JACKMAN.

SOUTH DAKOTA

No potatoes have been planted in the state owing to the delay in spring seeding of other crops. It appears that there will be some increase in acreage devoted to the growing of certified potatoes. Considerable certified seed has been imported from North Dakota as a source of seed for new growers. It is too early to estimate the acreage at this time. The report from the Agricultural Statistician's Office for acreages actually planted in the state will not be available until the 1st of July. However, their list as of the 1st of March, intentions to plant, shows 30,000 acres for the state.

Moisture conditions are good at the present time owing to the abundant spring rains which have prevailed. (May 12).—S. P. SWENSON.

VERMONT

Disappointing price returns during the spring marked the 1936-'37 potato deal for Vermont growers. Nevertheless a large part of stock, both for table and seed use have been moved on a market which afforded profit for the season even if it did not balance the bad years.

Though some certified seed sold as low as $1.00 and $1.10 for each bushel F. O. B. in carload lots, most of it brought approximately $1.40 with a few scattering small lot transactions as high as $2.00.

Some growers are inclined to question the accuracy of the stock-on-hand report of the 1st of January which showed Vermont with only about one-third of the 1936 crop left. It is not easy to keep an accurate record of the small lots stored in 25 or 30 thousand cellars. Certainly a smaller percentage of seed had been sold at that time than is usually the case.

Little, if any, planting had been done in Vermont at the date of writing and indications point to a late season. (May 12).—HAROLD L. BAILEY.

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Communicate with William H. Martin, New Jersey Agricultural Experiment Station, New Brunswick, N. J.

Virginia

The weather conditions during May have been excellent. The average stand and growth are about normal throughout most of the potato area. Heavy rains during the latter part of April leached considerable nitrogen from the light soils, but this has largely been replaced by side dressings of nitrogenous fertilizer. Digging will begin the first week in June. (May 15).—H. H. Zimmerly.

Washington

The potato situation in the state of Washington is anything but bright at the present time. Excessive rain and cold weather have handicapped farm operations. In many instances plowing has even been delayed and in those instances where it has been possible to prepare the soil and plant, the temperature has been so cold that very little growth has been possible.

The intended acreage is about 35 per cent above normal. However, it is difficult to secure definite information as to what effect the delayed planting will have upon the final acreage.

The demand for seed potatoes has been very active and the price ranges from $80.00 to $100.00 for each ton on the retail market. (May 10).—Chas. D. Gaines.

Canada

The intended acreage of potatoes this year is 501,000 compared with 496,400 in 1936, an increase of one per cent according to figures issued by the Dominion Bureau of Statistics on the 10th of May. The intended acreages are merely indicative of growers' plans about the first of May.

By provinces, the acreage this year compares with that of 1936 as follows, (Per cent of 1936): P. E. Island, 98; Nova Scotia, 99; Quebec, 101; Ontario, 193; Manitoba, 102; Saskatchewan, 96; Alberta, 103; and British Columbia, 102.

Compared with 1936, a somewhat larger acreage of potatoes for seed purposes is anticipated this season as some substantial export orders for certified seed for October delivery have already been booked. (May 11).—John Tucker.

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American Potato Journal

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

SOMERVILLE, N. J. NEW BRUNSWICK, N. J.

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THE DIETETIC VALUE OF THE POTATO

A recent release by the Bureau of Home Economics, U. S. Department of Agriculture, includes facts which every one interested in the potato industry should call to the attention of the consumer public. This article stresses that one potato of medium size contains no more calories than a large orange, or 1½ tablespoons of French salad dressing. It states that for those who are reducing, foods such as sugar, fats and oils should be eliminated before the potato, since they are considerably more fattening and do not carry any of the minerals and vitamins of the potato. The potato is a fair source of Vitamin C and also contains a little of Vitamins A. B and G. It makes an important contribution to the diet, too, through its minerals, particularly iron and phosphorus.

One of the striking statements in this release is that ". . . the indifference of some people to the potato is partly due to its being badly prepared so much of the time. Appearance, flavor, and food value are all influenced by cooking technique." We all appreciate the truth of this and look forward to the day when the potato, properly cooked, will occupy the place on the menu that it rightly deserves.

In this issue of the Journal, E. V. Hardenburg summarizes the information on the dietetic value of the potato. He cites results of investigations on this question which clearly indicate its importance in the diet.

It is important that the industry emphasize these points. The prevailing ideas concerning the potato must be changed if consumption is to increase. The National Potato Association, under the leadership of H. B. Tabb, has long appreciated this fact and plans are now under way to do something about it. There should be real support for this move. Those interested in the industry should assist in every possible way to help advance this campaign to call the attention of the public to the real value of the potato.